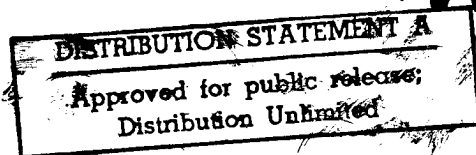
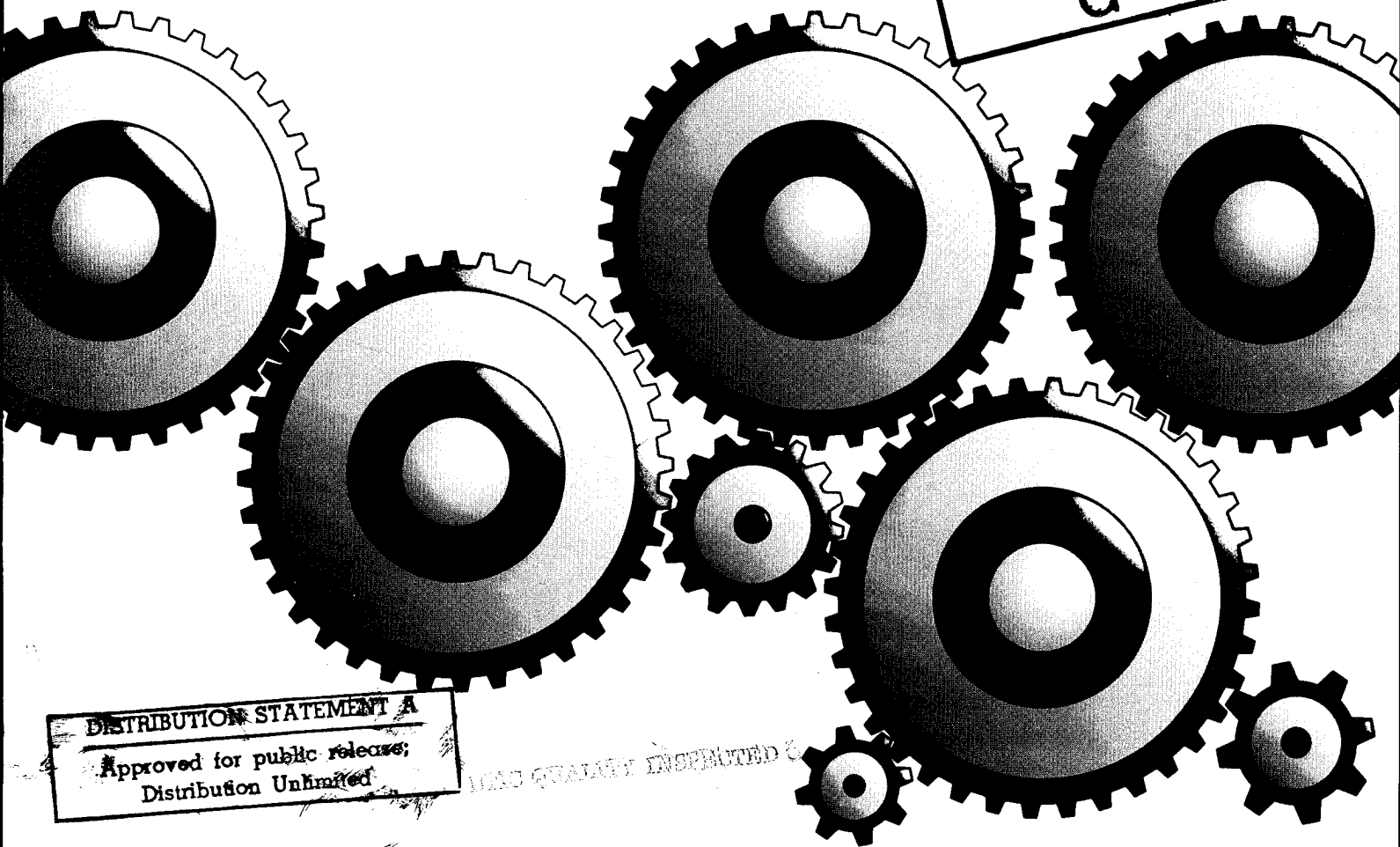




U.S. Army Corps of Engineers  
Water Resources Support Center  
Institute for Water Resources

# Infrastructure in the 21st Century Economy :

*An Interim Report - Volume 3  
Data on Federal Capital Stocks  
and Investment Flows*



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**Federal Infrastructure Strategy Program**

## Federal Infrastructure Strategy Reports

This is the ninth in a series of interim reports which will be published by the U.S. Army Corps of Engineers during the Federal Infrastructure Strategy program, a three-year effort to explore the development of an integrated or multi-agency Federal infrastructure policy. This report presents datasets on public capital and investment which were developed for use in this study to assess the effects of infrastructure on economic growth and productivity.

Other reports in the series thus far include:

Framing the Dialogue: Strategies, Issues and Opportunities (IWR Report 93-FIS-1);

Challenges and Opportunities for Innovation in the Public Works Infrastructure, Volumes 1 and 2, (IWR Reports 93-FIS-2 and 93-FIS-3);

Infrastructure in the 21st Century Economy: A Review of the Issues and Outline of a Study of the Impacts of Federal Infrastructure Investments (IWR Report 93-FIS-4);

Federal Public Works Infrastructure R&D: A New Perspective (IWR Report 93-FIS-5);

The Federal Role in Funding State and Local Infrastructure: Two Reports on Public Works Financing (IWR Report 93-FIS-6)

Infrastructure in the 21st Century Economy: An Interim Report - Volume 1 - The Dimensions of Public Works' Effects on Growth and Industry (IWR Report 94-FIS-7); and

Infrastructure in the 21st Century Economy: An Interim Report - Volume 2 - Three Conceptual Papers Exploring the Link Between Public Capital and Productivity (IWR Report 94-FIS-8).

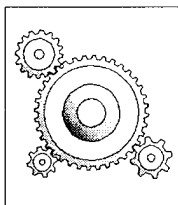
The program will culminate with a summary report to be published in 1994. The interim documentation contained herein is not intended to foreclose or preclude the program's final conclusions and recommendations. Within this context, comments are welcome on any of these reports.

For further information on the Federal Infrastructure Strategy Program, please contact Robert A. Pietrowsky, Program Manager at :

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The Federal Infrastructure Strategy study team includes Cameron E. Gordon, Economic Studies Manager and James F. Thompson, Jr., Engineering Studies Manager. The program is overseen by Dr. Eugene Z. Stakhiv, Chief, Policy and Special Studies Division, and Kyle Schilling, Director of the Institute.

Reports may be ordered by writing (above address) or calling Ms. Arlene Nurthen, IWR Publications, at (703)355-3042.



## The Federal Infrastructure Strategy Program

### INFRASTRUCTURE IN THE 21ST CENTURY ECONOMY



### AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS

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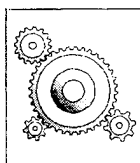
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# AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS

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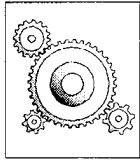
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## **AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS**

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### **ACKNOWLEDGEMENTS**

This report presents the interim developments in a study of the economic impacts of Federal infrastructure investments in transportation, water resources and supply, and waste management and is one element of a broad administrative directive, undertaken by the U.S. Army Corps of Engineers, and known as the Federal Infrastructure Strategy (FIS).

Special thanks are given to members of the interagency advisory panel which reviewed and analyzed many products and guided the study since its inception. Members in that panel which participated in the interim review meeting came from the Bureau of Reclamation of the U.S. Department of the Interior, the Federal Aviation Administration, Federal Highway Administration and Federal Rail Administration of the Department of Transportation, the Economic Research Service of the U.S. Department of Agriculture, the U.S. Department of the Army, the U.S. Office of Management and Budget, Jack Faucett Associates, the Upjohn Institute of Employment Studies, and the National Science Foundation. Representatives of the U.S. Environmental Protection Agency also provided guidance and useful input. The study's current progress would not have been possible without the vision and contributions of Dr. Charles Hulten of the University of Maryland at College Park, Dr. David Aschauer of Bates College, and Dr. M. Ishaq Nadiri of New York University, and the efforts of staff at Apogee Research, Inc.

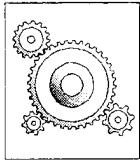
Policy guidance for the FIS program is provided by the Office of the Assistant Secretary of the Army (Civil Works) through Dr. Robert N. Stearns, Deputy Assistant Secretary for Project Management, while program execution is overseen by the Corps of Engineers Directorate of Civil Works through Donald Kisicki, Chief, Office of Interagency and International Activities.

The Corps Institute for Water Resources (IWR) has detailed management responsibility for the FIS program under the direction of Dr. Eugene Z. Stakhiv, Chief, Policy and Special Studies Division, and the FIS Study Team which includes Mr. Robert A. Pietrowsky, Program Manager, Mr. Cameron Gordon, Economic Studies Manager, and Mr. James F. Thompson, Jr., Engineering Studies Manager. Mr. Kyle Schilling is Director of the Institute.

This report is presented in three volumes and was prepared under the supervision of Mr. Cameron Gordon, who also wrote the introduction to Volume 1 and prepared the paraphrase proceedings in that volume. Ms. Arlene Nurthen of IWR deserves recognition for her efforts in editing and formatting this report for publication.







## AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS

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### PURPOSE OF THIS REPORT

The Federal Infrastructure Strategy (FIS) Program is a collaborative interagency study facilitated by the U.S. Army Corps of Engineers Institute for Water Resources designed to develop and stimulate implementation of an effective policy for managing and maintaining the nation's public works. This report presents developments in one element of that study, namely an effort to delineate and understand the effects of Federal infrastructure investments on the structure and functioning of the U.S. economy and the overall quality of life.

This interim report is a follow-up to a July 1993 publication entitled Infrastructure in the 21st Century Economy: A Review of the Issues and Outline of a Study of the Impacts of Federal Infrastructure Investments (IWR Report 93-FIS-4). That first report described the beginning of the effort in which the Corps presented a "strawman" scope of work to three different panels composed of professional economists and other staff from Federal agencies, Congress and academia, and solicited participation in devising a concrete research plan.

This report describes developments since that initial workplan was articulated and is printed in three volumes. This volume (**Volume 3**) contains the details of a database on public capital collected and developed by Apogee Research, Inc. These data, and other information currently being collected, will feed into three research tracks, described below, providing for consistency in each of those efforts in the data being analyzed (though one approach may need additional data that another does not). The datasets which have been collected are on investment flows (i.e. annual investments) and capital stocks (collections of annual investments, netting out depreciation) for Federal expenditures in the areas of transportation, water resources and supply, and waste management.

**Volume 1** contains an overview of the research effort as it is now being implemented, namely three related research tracks to capture the different dimensions of infrastructure's effects on the economy. The introduction to this volume lays out the separate research tracks - one for "telling the story" of how infrastructure investment affects economic structure, one for estimating those impacts numerically, and one for measuring the long-run impact on the macroeconomy - and describes the process which resulted in this research design. Following the introduction is a paraphrase proceedings of the panel meeting, held in October of 1993, in which the research design was analyzed and discussed.

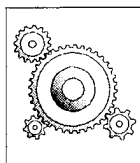
**Volume 2** contains the three technical papers which developed and documented the research approaches which form this study.

- \* The first paper, by Dr. Charles Hulten of the University of Maryland at College Park, describes the different theoretical ways in which public capital moves through the economy



and suggests that a model known as a Computable General Equilibrium (CGE) model be used to capture and delineate these effects.

- \* The second paper, by Dr. David Aschauer of Bates College, analyzes how public capital affects the overall economy in the long-run. He describes what is called a dynamic endogenous growth model which will be used to capture these long-term effects and estimate the "optimal" long-run level of public investment as well as how this optimum can be affected by different methods of financing (e.g. deficit versus taxes).
- \* The third paper, by Dr. Ishaq Nadiri of New York University, addresses the effect of public capital on specific industries and describes an econometric framework, using what are known as cost functions, for estimating infrastructure's impact on productivity within and across different sectors of the economy.



## **AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS**

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### **EXECUTIVE SUMMARY**

The U.S. Army Corps of Engineers Institute for Water Resources is sponsoring an interagency study of the relationship between public infrastructure and the nation's economic productivity and growth as part of the Federal Infrastructure Strategy (FIS) Program. The debate over the extent to which public infrastructure impacts the private economy has produced a variety of empirical results employing different assumptions, methodology, and data. Criticisms of these results have focused upon each of these elements. As a result, a primary goal of the FIS effort is to extend and improve alternative empirical methodologies, and identify, collect and construct data relevant for this purpose. Due to the empirical nature of the infrastructure debate, the quality, and level of detail, of available data are important factors. This report describes the overall data collection effort for this project as it relates to these characteristics.

Categories of public infrastructure specific to this project include: highways; aviation; mass transit; water supply; water resources; wastewater treatment; and hazardous and solid waste. Particular emphasis is placed upon obtaining data relevant for the empirical analyses developed as part of this project: cost and production function approaches; and benefit-cost analysis. To support advances in the empirical approaches, data collection efforts emphasized the following levels of detail:

- Geographic;
- Functional;
- Expenditure type; and
- Level of Government.

Data at the state level are found to be most consistently available to meet the needs of the empirical analyses. Capital outlays represent the expenditure category of primary importance for this study, as they represent purchases of construction, equipment, and land, and therefore form the foundation of public capital stocks. As all government units are involved in planning, developing, and funding infrastructure projects, the report focuses on data measuring infrastructure expenditures, by each level of government, and construct public capital stock information from these data.

Data sources meeting these needs include Bureau of the Census, U.S. Department of Commerce, Government Finances census and survey data, Census' Federal Expenditures by State, and individual federal agencies, particularly the U.S. Army Corps of Engineers and the Federal Highway Administration.

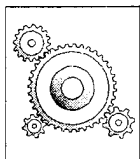
Capital expenditure data provided by these sources allow construction of public capital stock data, on a state by state basis, for all of the above infrastructure categories except hazardous waste. Other studies have made use of these data sources, at the state level, in their analyses. However, they have not had available the functional detail of public capital stock provided by this report. In addition, as the



assumptions underlying estimation of public capital impact the results achieved, two capital stock series were prepared for each infrastructure mode, employing alternative asset decay patterns to examine the sensitivity of the results to these assumptions.

To complete the data requirements, private sector data, including output, employment, earnings, capital stock and price information were also obtained. Much of this data, at the state and industry level, is provided by the Bureau of Economic Analysis, U.S. Department of Commerce. Population, personal income, earnings, employment, and gross state product are obtained from this source. Relevant price indices are obtained through several federal agencies. Private capital stock, by state and industry, is an important component for this study. While information necessary for a comprehensive state by industry data series is not readily available, possible alternatives are being examined.





## AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS

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### INTRODUCTION

The Institute for Water Resources, U.S. Army Corps of Engineers is conducting a Federal Infrastructure Strategy Program (FIS), an ongoing interagency project to assess the relationship of public infrastructure to the nation's productivity, economic growth, and quality of life. As part of the overall project, the Corps retained Apogee Research, Inc. to specify alternative empirical frameworks by which to assess this relationship, and collect and construct data relevant for this purpose. The empirical implementation of the proposed frameworks is to be undertaken in a subsequent phase of the project.

This report presents the data identified, collected, and constructed for these purposes. The categories of public infrastructure specific to this study include: highways; aviation; mass transit; water supply; water resources; wastewater treatment; and hazardous and solid waste. The focus of the present data collection effort is to obtain information specific to these categories with an emphasis on:

- **Expenditure data** -- Identifying and collecting expenditure data for all levels of governmental involvement in infrastructure investment; and
- **Public capital stock** -- Constructing public capital stocks for each infrastructure category based upon expenditure data.

### DESCRIPTION OF REPORT

This report describes expenditure and public capital stock data obtained for the subsequent empirical analyses. Performance related data that may be incorporated into the empirical analyses will be obtained as necessary and available. The report documents the data collected, data sources, gaps in current data, and assumptions and methodology used in constructing selected data series.

### OVERVIEW OF FINDINGS

The goal of this effort is to advance understanding of the relationship between infrastructure investment and economic productivity and growth. Because of policy and political interest in this area, empirical measurement of this relationship is important. Therefore, as part of the Corps' FIS, this project extends current empirical efforts by advancing both methodology

and data inputs. To achieve this goal, there is a focus on alternative methodological approaches: cost and production function models; and programmatic benefit-cost. In support of these approaches, attempts have been made to extend the level of detail and quality of data. This document reports on the data collection effort. Separate reports regarding the alternative approaches, prepared by the following individuals, are provided in Volume 2:

- Dynamic growth: David Aschauer, Ph.D., Bates College;
- Cost function: M. Ishaq Nadiri, Ph.D., New York University; and
- Benefit-Cost: Charles Hulten, Ph.D., University of Maryland.

Data required for these analyses include public expenditure and capital stock information, and private sector output, employment, earnings, capital stock and price information. Public capital stock in the context of this report refers to the above list of infrastructure categories. Other significant sources of public capital, such as education, communications, electric utilities, and privately held/publicly regulated utilities, are not accounted for in this study.

## **Data Aggregation**

One criticism of previous empirical efforts is the lack of data in sufficient detail to allow a more complete understanding of the impact infrastructure investment has on economic activity. To respond to this deficiency, the goal was set to obtain and collect public capital flow and stock data in sufficient detail to support advances in methodology. The type of detail considered in the collection process includes geographic (national, state, etc.), functional (infrastructure modes), expenditure type (direct, indirect, etc.), and level of government (federal, state, and local). In all cases, attempts were made to obtain data with a sufficient time series to be useful in the analysis.

The expenditure, or flow, data provide important information regarding patterns of governmental involvement in the various categories, which can be used for examining future trends. In addition, flow data form the basis for estimating public capital stocks for each infrastructure mode.

Geographic Aggregation. Data at the state level are most consistently available to meet the needs of the empirical analyses. Relevant expenditure data available at levels below the state level, such as county or project level, are aggregated to the state level, if possible.<sup>1</sup> While other studies have used state data in their analyses, they have not had the degree of functional detail available for this project.

Functional Aggregation. The functional categories of interest are the infrastructure categories listed at the outset of this report. Other infrastructure modes are not considered for this effort.

Type of Expenditure. There are two primary types of expenditures for public infrastructure: direct and indirect. Direct expenditures are composed of capital outlays, maintenance, operations, administration, and interest on debt. Indirect expenditures primarily include grants and loans from one agency or level of government to another. These funds may be earmarked for specific uses within a functional category and may require matching funds from the receiving party.

Generally, expenditures for operations, maintenance, and administration are not available as separate items, but combined in a single category. Interest on debt is available for selected modes. Availability of capital outlays is important for this study as it represents purchases of construction, equipment, and land, which add to the current capital stock. Therefore, a goal in obtaining expenditure flows in sufficient detail is to allow construction of public capital stocks.

Accounting for source and use of funds by government level and infrastructure category is difficult. At the national level, total expenditures by "own source" can be determined using expenditure data provided by the Bureau of the Census, U.S. Department of Commerce. However, information as to whether federal grants to state and local governments are used for capital outlays or operations and maintenance can only be approximated. At the state level this becomes more problematic since federal government expenditures are unavailable in a consistent manner.

Level of Government. The focus of this report is on "planned federal infrastructure investments." Federal involvement in infrastructure investment may take the form of both direct and indirect expenditures, primarily to state and local governments. Thus, all levels of government are involved in planning, developing, and funding infrastructure projects. As a result, the data collection attempted to obtain expenditure information by all levels of government.

## **Public Expenditure Data**

Primary sources of public expenditure data include:

- Census, Government Finances census and survey;
- Congressional Budget Office;
- Individual federal agencies; and
- Census, Federal Expenditures by State.

Census, Government Finances. At the federal, state and local government level, data collected by the Bureau of the Census, U.S. Department of Commerce, Government Finances survey provide information meeting most of the goals established above.

Advantages of these data include the following:



- They represent a consistent source of expenditure data for most of the infrastructure categories within the scope of this study (not including hazardous waste and only indirectly providing water resources);
- State and local government expenditures are available by level of government and state from 1977 through 1990;
- Federal, state, and local government expenditures are available at the national level from 1902 through 1990 (continuously from 1952);
- Expenditures are identified by type, including capital outlays and construction; and
- Direct expenditures, by level of government, include funds from all sources, including federal government grants.

Limitations are that the data, by state, for all the infrastructure categories, are available only for fiscal years 1977 to 1990, and federal expenditures are only available nationally. The latter is a limitation found not only with this source, but within specific federal agencies.

Congressional Budget Office. The Congressional Budget Office (CBO) maintains expenditure data for infrastructure categories similar to those of this study: highways; mass transit; rail; aviation; water transportation; water resources; water supply; and wastewater treatment.<sup>2</sup> The present study excludes rail expenditures, and includes solid waste management.

However, these data are at the national level only. In addition, state and local government expenditure data are from the Bureau of the Census, U.S. Department of Commerce, Government Finances survey -- the same source from which Apogee obtained state level expenditure data.

Federal expenditures in the CBO database are obtained from federal budget data, provided by the Office of Management and Budget (OMB). Budget data are identified by subfunction, and contain both direct and indirect expenditures. These data are not available at the state level. Federal CBO data differ from Census data in that Census does not recognize all of the infrastructure categories as functions of the federal government. Specifically, federal indirect expenditures for sewerage and solid waste management are unavailable as separate items from Census (they are included in the "other" general expenditures). In addition, Census data are grouped by function, while OMB data are grouped by program. There is likely a large degree of overlap between the two, yet these sources are not directly comparable.

Census, Federal Expenditures by State. At the state level, federal grants to state and local governments are available, by agency and project, through Census' *Federal Expenditures by State*, and its predecessor, *Federal Aid to States*. These sources do not identify the specific use



made of these funds, such as capital outlay or operations, by the government unit. These data are generally consistent with federal expenditures reported in the CBO database, as OMB attempts to reconcile their totals with those of Census.

However, these program level data are inconsistent with Census, Government Finances expenditure data which are categorized by function. While this presents a problem in accounting for sources and uses of funds, there is sufficient expenditure detail to determine current expenditure trends by level of government to be useful in the empirical analyses.

Individual Federal Agency Data. Detailed capital outlays are obtained from the U.S. Army Corps of Engineers and the Federal Highway Administration. Contacts with other agencies often indicated that information collected by Census, Government Finances represents the best source of expenditure data, and additional detail was either not available or too costly to obtain. Some agency specific grant information is available, by state, for selected functions, which augments data available in *Federal Expenditures by State*.

### **Public Capital Stock<sup>3</sup>**

An important goal of the data collection effort is to obtain expenditure flows sufficient to construct detailed capital stock estimates. The expenditure flows discussed above are used to estimate capital stocks, by state and function.<sup>4</sup>

Capital stocks constructed from Census, Government Finances expenditures, are available for the following categories:

- Highways;
- Mass Transit;<sup>5</sup>
- Air Transportation;
- Water Transport and Terminals;
- Water Supply;
- Sewerage; and
- Solid Waste Management.

These Census categories generally correspond to the categories of this study. Sewerage is comparable to wastewater treatment, and is used interchangeably. Water transport and terminals is a component of the broader category of water resources. Data sufficient to construct hazardous waste capital stock by state are not available; expenditures for this function are primarily made by the federal government or the private sector.<sup>6</sup>

Capital stocks are estimated from state and local government investment flows using the perpetual inventory method. As expenditure flows for these categories are available from 1977 through 1990 by state, national capital stocks are estimated for the purpose of providing a 1976 benchmark, from which the individual state flows are accumulated.



As mentioned above, federal capital outlays for these Census functions are not available by state. However, not much information is lost by considering only state and local government expenditures. Federal capital outlays for highways are made primarily for defense facilities and national parks, and represent only a small percentage of total highway capital outlays. There are no federal capital outlays for mass transit, sewerage, water supply, and solid waste management. Federal expenditures for water transport and terminals are accounted for using data from the Corps, discussed below.

Federal capital outlays for air transportation can be sizeable. However, information regarding the distribution of these expenditures by state is not generally available, based upon discussions with the FAA. As a result, public capital for air transportation at the national level is estimated based upon outlays by all governments, and state and local government. At the state level, air transportation capital stock is constructed based upon only state and local government outlays.

U.S. Army Corps of Engineers expenditures flows provide the basis for capital stocks in the following functions:

- Navigation;
- Flood Control;
- Mississippi River and Tributaries (MRT); and
- Multipurpose, including power.

MRT includes expenditures for both navigation and flood control purposes, which are approximated by a fixed 25/75 split. These four categories constitute the federal component of the water resources category. Rough correspondence between these Corps categories and Census' natural resources and water transport and terminals categories can be made as follows:

- Natural Resources includes flood control, MRT, and multipurpose; and
- Water Transport and Terminals includes navigation.

Direct expenditures by other federal agencies are included in the federal component of Census' natural resources data, such as Tennessee Valley Authority (TVA), Bureau of Reclamation, and the Soil Conservation Service. Unfortunately, expenditures on electric power, and soil and water resources are combined in this category. Even the Corps multipurpose expenditures combine electric power with navigation and flood control.

While expenditures for hydro-electric power generation have navigation and flood control benefits, power generation is not directly relevant for this study. The Soil Conservation Service primarily provides grants to state and local governments, which are included in their total expenditures, by function. Bureau of Reclamation expenditures for construction and operations and maintenance are available only at the national level, from 1950 to 1987, and therefore not

included in the calculation of federal water resources capital stock. As a result, the substantial portion of federal capital outlays for water resources is captured by the Corps data.

Another component of water resources is the state and local government portion of natural resource expenditures attributable to this function. State and local expenditures for this category, as collected by Census, are composed of agriculture, forestry, and "other" natural resources. The latter category includes expenditures for the regulation of water and mineral resources, and gas and oil drilling, plus irrigation, drainage, flood control, land reclamation, etc. An attempt is being made to obtain an approximation of the proportion water resources are of these "other" expenditures.

The Federal Highway Administration (FHWA) provided expenditure data from which an additional highway capital stock series is estimated. The data allow estimation of national capital stocks from 1921 through 1990, and state stocks from 1957 through 1990, based upon capital outlays by all levels of government.

The complete series of public capital stocks, at the state level, cover a common period, from 1977 through 1990. It may be desirable for the empirical models to have longer time series of capital stock. Longer time series for selected infrastructure modes are available (e.g., highways and the Corps' categories). However, there will likely be some tradeoff between degree of functional detail and length of time data are available. To accommodate this need, it may be necessary to combine or eliminate selected categories, based upon preliminary analysis of the 1977-1990 data.

### **Private Sector Data**

The Bureau of Economic Analysis, U.S. Department of Commerce is a significant source of private sector data at the state level. Population, personal income, earnings, employment, and gross state product (GSP) are obtained from this source. Earnings, employment, and GSP are also available at the industry level.

Private capital stock, by state and industry, is an important component for this study. A search is continuing for a suitable source of this information. Information required to estimate the cost of capital, needed for the cost function methodology, on a state basis, is on-going, with Professor Nadiri's assistance.

Capital stocks are constructed using a national level price deflator applied to individual state investment flows. In addition, state capital stock estimates derived from Census data are based upon a national deterioration rate.<sup>7</sup> These assumptions are made due to the lack of available state specific price deflators or deterioration rates.



## Summary

Capital flows and their related stocks rely largely on data collected by the Bureau of the Census. This source has the advantage of providing data collected consistently over a long period of time, with a great degree of detail, both geographically and functionally. These characteristics are important for this study to make the methodological advances required.

Census data allow estimation of capital stocks for almost every mode within the scope of this study, by state. This, augmented by capital stocks estimated from the U.S. Army Corps of Engineers and Federal Highway Administration data present the most comprehensive set of public capital stocks currently available. While other studies have relied upon Census, Government Finances expenditure data for capital stock estimation, including the recent work of Douglas Holtz-Eakin, and Michael Bell and Therese McGuire, they do not contain the level of functional detail provide here.

Holtz-Eakin focuses on total public capital, and uses this to derive state estimates for specific functional categories, including streets and highways, sewerage, and utilities from 1960 to 1988. The work in progress of Bell and McGuire uses the same state level Government Finances data employed here, yet, because their emphasis is primarily transportation, they do not include solid waste management or the Corps of Engineers component of water resources.

In addition, two alternative capital stock estimates are provided, based upon different decay patterns, which provide some bounds on the level and rate of growth in capital stock. It is hoped that an examination of the impact alternative decay patterns have on the empirical results will further the understanding of the public infrastructure debate.

## PLAN OF REPORT

The remainder of the report is presented in three chapters with associated appendices. Chapter I presents more detailed information regarding expenditure data. Chapter II presents details of the public capital stocks constructed from the expenditure data, including:

- Assumptions and methodology used to construct capital stocks; and
- Graphical presentation of capital stocks, by mode.

Chapter III describes the private sector information obtained for the analyses, including:

- Price indices; and
- General economic and demographic information such as population, earnings, and employment.

Chapters I through III group the data by level of aggregation, either national or state. Appendices I through III present details, for the respective chapter, of:

- Methodology and assumptions; and
- Data files and layouts.

Appendix IV provides a description of functional categories in this study for which Government Finances collects expenditure information.



## INTRODUCTION ENDNOTES

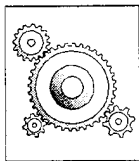
1. Expenditure data provided by the U.S. Army Corps of Engineers for the years 1979 to 1991 is identified by Corps region and project. However, these data are not readily aggregated to the state level, and therefore are not preferred to other data provided by the Corps, which does not have the same level of detail, yet is aggregated to the state level. The more detailed data may be of use for benefit-cost model or a case study.
2. Apogee has a copy of the CBO database in machine readable format. However, an updated version has recently been released, which we hope to obtain.
3. Details of the estimation of public capital stocks are provided in Chapter II and Appendix II.
4. Recent and related work in the area of state level public capital stocks includes: Douglas Holtz-Eakin, "State-specific estimates of state and local government capital," *Regional Science and Urban Economics*, 23(1993), pp. 185-209, North Holland; and work in progress by Drs. Michael Bell and Therese McGuire for the Transportation Research Board, NCHRP, Project 2(17)-3. Assumptions and methodology from both of these studies, and the Bureau of Economic Analysis, are incorporated in our capital stock estimates.
5. The primary source of capital and operating expenditures on mass transit used in this report is from the Census, Government Finances, at both the national and state level. The Federal Transit Authority, U.S. Department of Transportation, administers the Section 15 Reporting System, which maintains substantial information on the nation's mass transit systems. The data presented in the annual reports are available in machine-readable format from 1983 to 1991; Apogee has requested this information.  
  
However, Section 15 data are limited in that capital expenditures, by transit system, are not provided prior to 1991. Beginning with the 1991 report, capital expenditures, by transit system and type of expenditure, are available. Operating expenditures and performance related data, by transit system, are available from 1983 to 1991.
6. Private sector pollution abatement expenditures for hazardous and solid waste, by state, are published from 1983-1986 and 1988-1990 in *Pollution Abatement Costs and Expenditures*, Current Industrial Reports, Bureau of the Census, U.S. Department of Commerce. No survey was conducted in 1987.



7. The terminology used herein attempts to be consistent with that presented in the paper by Jack Triplett to the Workshop on the Measurement of Depreciation and Capital Stock, Conference on Research in Income and Wealth, titled "Measuring the Capital Stock: A Review of Concepts and Data Needs", National Bureau of Economic Research, June 1992.

Deterioration defined therein is the combination of decay and retirements. Patterns of decay employed in this report are straight-line and economic, often referred to as patterns of depreciation.





## AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS

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### CHAPTER I: PUBLIC INFRASTRUCTURE INVESTMENT

#### OVERVIEW

The purpose of this data collection effort is to identify and obtain infrastructure investment information at all levels of government, by state. Investment in infrastructure can be either direct or indirect. Generally, direct expenditures include capital outlays and operations and maintenance, while indirect expenditures are primarily transfers of funds from one government level to another, usually in the form of grants or loans. The investment, or flow, data is useful in its own right for analyzing trends in government expenditures within each infrastructure category. In addition, expenditure flows are commonly the basis for estimation of capital stocks, using the perpetual inventory method of investment accumulation.

Expenditures by state and local governments are available from the Bureau of the Census, U.S. Department of Commerce, Government Finances survey. This information is available at the state level for fiscal years 1977 to 1990, and nationally from fiscal years 1902 through 1990 (continuously from 1952 forward).

Federal government expenditure data is generally available on a national level. One goal of the present effort is to obtain more detailed federal expenditure information at the state level, in order to augment the state and local government expenditure and subsequent capital stock data, if necessary. To accomplish this, contact with individual agencies was made to determine the existence and availability of relevant expenditure data, the results of which are presented in this chapter.

The source of federal government expenditures varies by infrastructure category and by expenditure type, direct or indirect. A primary source for federal grants to state and local governments, by state and federal program, is Table 2 of Census' *Federal Expenditures by State*, and its predecessor, *Federal Aid to States*, published by the U.S. Department of Treasury. These sources provide federal grant expenditures to state and local governments by federal agency and program.

The grant data are compiled by the Census from information provided by each federal agency. These annual grant totals differ from those presented in the OMB budget tables,





Schedule C (or Special Analysis D prior to 1990), in that Table 2 represents total grants, while the OMB data identifies grants for investment outlays and other purposes. The budget data from OMB are available only at a national level. Otherwise, they represent consistent data sources.

Government Finances provides national totals for federal government direct and indirect expenditures by function. These data are based upon functional expenditure categories, while the data in *Federal Expenditures by State* are based upon programmatic expenditures. Therefore, the grant information presented in *Federal Expenditures by State* are not necessarily consistent with the indirect expenditures contained in the Government Finances series. The information is collected by two different divisions within Census and the two series are not reconciled. Because Government Finances data are based upon functional category, they are likely more representative of the federal contribution to a specific infrastructure category than the program data.

Much of the federal agency data available beyond that in *Federal Expenditures by State* also represents intergovernmental transfers to state and local governments, primarily in the form of grants. Because of the difference between the program and function based data sources, it is difficult to use the state by state information to measure "own-source" expenditures by state and local governments.

## **PUBLIC EXPENDITURE DATA**

A primary source of both national and state level expenditure data is the Bureau of the Census, U.S. Department of Commerce, Government Finances survey.<sup>1</sup> Expenditure data were obtained for the following functions, at both the state and national level:

- Highways;
- Air Transportation;
- Mass Transit;
- Transit Subsidies;
- Water Transport and Terminals;
- Natural Resources;
- Water Supply;
- Sewerage; and
- Solid Waste Management.

For purposes of the categories within the scope of this study, sewerage is treated interchangeably with wastewater treatment. Water transport and terminals is one component of the broader water resources category. Expenditure data for natural resources was collected to augment the water resources category. As mentioned in the Introduction, this category includes expenditures on agriculture, forestry, and "other." This latter category includes expenditures for soil and water resources, as well as electric power and resource regulation. Further information regarding the

proportion water resources is of the total is needed in order to estimate this portion of water resources. Transit subsidies represent state government transfers to private transit companies.

The historical, national level, expenditure series, is available from fiscal years 1902 to 1990; and state level expenditure series, from fiscal years 1977 through 1990. These two levels of data represent consistent data sources as the national totals from the state level data are equal to the totals in the historical series.

For each category, the following expenditure information has been collected:

- Total expenditure;
- Direct expenditure;
- Intergovernmental expenditures;
- Interest on debt;
- Current operations;
- Capital outlays; and
- Construction expenditures.

The following identities hold:

- Intergovernmental expenditures (IGE) are the difference between total and direct expenditures; and
- Direct expenditures equal the sum of capital outlays, current operations, and interest on debt, where interest on debt is available only for mass transit and water supply expenditures.

Because these expenditures are by functional category, regardless of funding source, all federal grants and loans to state and local governments applied to a specific category are included in state and local direct expenditures.<sup>2</sup>

These data provide a consistent set of expenditure information across the infrastructure modes, and form the basis for constructing capital stocks, described in the following chapter. National and state data differ primarily in the level of government detail and years for which data are available, as described below.

## **National Expenditure Data**

### **Census, Government Finances**

National expenditure data were provided to Apogee by Census through the Advisory Commission on Intergovernmental Relations. Data are available for the following years: 1902;



1913; 1922; 1927; every other year from 1932 to 1950; and every year from 1952 to 1990. Appendix I-1 provides the years for which specific information is available, by mode, as well as a description of the file format.

The data distinguish between federal government expenditures, state and local government expenditures, and federal, state, and local governments combined. State and local government expenditure data are not available separately in the historical series.

### **Federal Highway Administration**

A variety of data were obtained from the Federal Highway Administration covering capital outlays and maintenance expenditures. For the years 1921 through 1992, the following national level data are available:

- Total expenditures for highways, by all levels of government;
- Capital outlays for highways, by all levels of government;
- Maintenance expenditures for highways, by all levels of government; and
- Other expenditures for highways, by all levels of government.

Total expenditures include capital outlays, maintenance, administration, highway and police safety, and bond interest.<sup>3</sup> Total capital outlays and maintenance include expenditures for the following categories of roads:

- State administered highways;
- Local rural roads;
- Local municipal streets; and
- Federal roads and unclassified.

Capital outlays include right-of-way costs. In 1990, capital outlays for state administered highways accounted for 70.6 percent of total capital outlays, while maintenance for state administered highways was 40.6 percent of total maintenance.<sup>4</sup> These percentages will change over time due in part to changes in what are considered state administered highways. Appendix I-2 details the data available.

## **State Level Expenditure Data**

With the exception of expenditure data from the Census, U.S. Army Corps of Engineers, and Federal Highway Administration, the following state level data represent grants from federal government agencies to state and local governments by type of project.

### **Census, Government Finances**

State level expenditure data are available for fiscal years 1977 through 1990 for state and local governments combined and separately, for the above infrastructure modes and expenditure types. Federal expenditures are available on a national basis only. The state and local government expenditures provide the basis for capital stocks for each infrastructure mode, described in detail in Chapter II. Appendix I-1 presents the details of the available information.

### **Federal Highway Administration**

The Federal Highway Administration provided the following data on a state by state basis (see Appendix I-2 for additional details):

- Capital outlays on highways, by all levels of government, from 1957 through 1990;
- Maintenance expenditures on highways, by all levels of government, from 1957 through 1990;
- Capital outlays on state administered highways, from 1921 through 1991; and
- Maintenance expenditures on state administered highways, from 1921 through 1991.

The capital outlay data, by all levels of government, provides the basis for construction of an additional highway capital stock series, from 1957 to 1990. The Bell and McGuire NCHRP study constructed a highway capital stock series incorporating both the capital outlay and maintenance expenditure data. They augmented this information with additional state level data, allowing a longer time series of state-wide expenditure data. Their resulting capital stock series has been requested through NCHRP.

### **U.S. Army Corps of Engineers**

The U.S. Army Corps of Engineers provided data covering civil works expenditures, by state, from fiscal years 1936 through 1992.<sup>5</sup> These data provide the basis for federal water



resources capital stock, by state, described in Chapter II. The data contain total expenditures for the following functions:

- Navigation;
- Flood Control;
- Multipurpose, including Power; and
- Mississippi River and Tributaries (MR-T).

For each function, expenditures for "new work" and "operations and maintenance" are provided. New work consists primarily of construction, and also includes expenditures for preliminary survey work and other non-structural, non-equipment expenditures. Expenditures are grouped by each project's primary purpose, even if benefits of that expenditure extend to other categories (e.g., some navigation projects have flood control benefits).

Navigation includes expenditures for two subdivisions, channels and harbors, and inland waterways. Channels and harbors consists primarily of deep draft dredging while inland waterways consists primarily of locks and dams.

Flood control expenditures include the subdivisions local protection, and reservoirs. Local protection includes expenditures on levees and dams. Multipurpose expenditures are primarily for hydro-electric purposes.

Expenditures for the Mississippi River and its tributaries (MR-T) include both navigation and flood control expenditures. Expenditures for this function are made predominantly to eight states: Louisiana; Mississippi; Arkansas; Tennessee; Missouri; Kentucky; Iowa; and Illinois. According to the Corps, the "rule of thumb" is 75 percent of MR-T expenditures are for flood control, with the remaining 25 percent for navigation. Additional details are provided in Appendix I-3.

The Corps also provided expenditure data at the project level, by Corps Division and District Office, from fiscal year 1979 through 1990. Expenditures for the following functions are contained in the data:

- Locks and Dams;
- Reservoirs;
- Multipurpose;
- Local Protection; and
- Channels and Harbors.

The data include direct expenditures for construction, major rehabilitation, operations and maintenance, other activities, and pre-construction engineering and surveys. While the data have project level detail, they are not readily identifiable by state. Therefore, they are not used in the construction of capital stocks.

## **Appalachian Regional Commission**

The Appalachian Regional Commission (ARC) provided data for water supply, wastewater (sewerage), and solid waste. These are grant dollars provided to state and local governments for these functions, and are available from 1966 to 1992. The data are described in Appendix I-4.

## **Economic Development Administration**

Grants to state and local governments for sewerage and water supply are available from 1966 to 1992. The original source data are at the project level, by state and SIC code. They are aggregated to state totals for water supply and wastewater treatment by combining SIC categories as directed by EDA. Appendix I-5 details the aggregated data.

## **Federal Expenditures by State**

Federal grants to state and local governments, by agency and program, are available from *Federal Expenditures by State*, the Bureau of the Census, U.S. Department of Commerce. Data for the following related programs are available from 1969 to 1992:

- Highway Trust Fund, Federal Highway Administration, U.S. Department of Transportation;
- Airport and Airway Trust Fund, Federal Aviation Administration, U.S. Department of Transportation;
- Urban Mass Transportation Administration, U.S. Department of Transportation.
- Flood Control Act of 1954, U.S. Army Corps of Engineers;
- Water and Sewer, U.S. Department of Housing and Urban Development;
- Construction of Wastewater Treatment Works, Environmental Protection Agency; and
- Rural Water and Waste Disposal, Regional Development Administration (formerly Farmers Home Administration), U.S. Department of Agriculture.

These data are obtained from Table 2, *Federal Expenditures by State* from 1982 to 1992, and for 1969 to 1981, from *Federal Aid to States*.



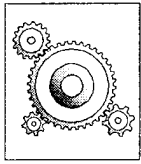
Rural water and waste disposal grants include monies for water supply and wastewater treatment. According to the Regional Development Administration, the best allocation of total expenditures, by function, is 60 percent for water supply, with the remaining 40 percent for wastewater treatment. Total grant expenditures are allocated in this manner, and available as separate components as described in Appendix I-6.

## CHAPTER I ENDNOTES

1. The Bureau of the Census conducts a census of state and local governments every five years, and a survey of these governments for the intervening years. Reference to Government Finances, and Government Finances survey is intended to include both the census and survey. The data provided by the Census include both sources.
2. See Appendix IV for detailed descriptions of these functional categories. Solid waste management was formerly titled "Sanitation Other than Sewerage." The title was changed to more accurately reflect the expenditure data in the series and no change was made to the series itself.
3. Total disbursements for highways includes total current expenditures and bond redemptions.
4. *Highway Statistics 1991*, Federal Highway Administration, U.S. Department of Transportation, Table HF-2, p. 44.
5. The original data file contains multiple records per state per year. After discussions with the Corps and a comparison of expenditure totals, by category, to a Corps provided hard-copy report, it was determined to retain all records. Multiple records are summed to one record per state per year. Expenditures for the 50 states and the District of Columbia are retained, even though minor expenditures are reported for other geographic areas.







## **AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS**

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### **CHAPTER II: PUBLIC CAPITAL STOCK**

#### **OVERVIEW**

Public capital stock is fundamental to the debate over infrastructure investment and productivity, placing significant emphasis on both its measurement and level of aggregation. Public capital is often measured by the perpetual inventory method, which accumulates investment flows over time, given assumptions regarding asset life, decay, retirements, and obsolescence. This method is employed largely because investment flow data are available to perform the calculation. Public capital stocks constructed for this study are measured using this approach as well. However, the capital stocks provided herein are at a level of aggregation not previously available for, and thus not incorporated into, research in this area.<sup>1</sup>

It has been argued that productivity studies using national level data are too aggregate, and that time-series data alone cannot adequately capture the relationship of public capital to private output. While other studies incorporate state level public capital into their analysis, the level of modal detail provided here represents a significant move forward in both geographic and modal disaggregation. The level of detail now available allows a more detailed investigation into the relationship between public capital and private productivity, both across states and infrastructure modes. In addition, the relationship among different infrastructure modes, and the implied alternative investment choices, may be more fully explored.<sup>2</sup>

Two recent studies providing public capital stock at the state level incorporate the perpetual inventory approach. Douglas Holtz-Eakin presents estimates of state and local government capital stocks using Census Government Finances expenditure data and national public capital stocks from the U.S. Department of Commerce, Bureau of Economic Analysis.<sup>3</sup> Current work in progress by Drs. Michael Bell and Therese McGuire, for the Transportation Research Board, NCHRP, prepared capital stocks at the state level using Census Government Finances expenditure data for many of the same infrastructure categories as this effort. Methodology and assumptions from both of these studies and from the BEA, are incorporated here.

Public capital stocks were constructed at both the national and state level. National capital stocks are based upon Census Government Finances and Federal Highway Administration



(FHWA) expenditure data. State specific capital stocks are derived from Census, FHWA, and U.S. Army Corps of Engineers expenditure data. Construction of national capital stocks is required to provide a benchmark for the state capital stocks based upon Census and FHWA data.

Capital stocks derived from Census data, both national and state-level, are based upon state and local government capital outlays, by function, which includes all sources of funds. The national and state level capital stock series obtained provide a consistent set of information on infrastructure capital. In addition, capital stock at the national level for air transportation is constructed based upon capital outlays by all levels of government, and by only state and local governments.

Expenditure data provided by the Corps allow construction, by state, of federal water resources capital stocks. This provides important detail not available through the Census data and augments the water transport and terminals capital series obtained from that source. The combined state level capital stocks thus provide a comprehensive source of infrastructure capital.

The pattern of decay assumed in implementing the perpetual inventory method impacts on the results obtained. Two general approaches are straight-line and economic, or efficiency, decay. Holtz-Eakin benchmarks his state and local capital stocks to national estimates produced by the BEA, which assumes straight-line decay in their estimates. It has been argued that straight-line decay may not be appropriate if the resulting capital stocks are to be used in a productivity study, and that economic decay is more appropriate for this purpose. The Bell/McGuire capital stocks are constructed under the assumption of economic decay.

Two capital stock series were constructed for each infrastructure mode, based upon straight-line and economic decay. The results of the two decay patterns differ in both the stock's level and rate of growth. Incorporating each capital stock series into the empirical analyses may provide insights regarding the sensitivity of results to these decay assumptions.

The remainder of this chapter details the methodology and data used in constructing national and state level capital stocks, and presents the results of these calculations.

## **NATIONAL PUBLIC CAPITAL**

### **Census Government Finances**

National capital stocks are based upon Government Finances expenditure data from 1932 through 1990 for the following categories:<sup>4</sup>

- Highways;
- Air Transportation;
- Mass Transit;

- Water Transport and Terminals;
- Sewerage;
- Water Supply; and
- Solid Waste Management.

For all categories except air transportation, state and local government capital outlays are used. Not much information is lost by considering only state and local government expenditures for these categories. Federal capital outlays for highways are made primarily for defense facilities and national parks, and represent only a small percentage of total highway capital outlays. There are no federal capital outlays for mass transit, sewerage, water supply, and solid waste management. Federal expenditures for water transport and terminals are accounted for using data from the Corps, discussed below.

However, as federal direct capital outlays for air transportation can be significant, we provide capital stock for air transportation, at the national level, based upon capital outlays by all governments, and state and local governments only. At the state level, air transportation capital stock is constructed from state and local government outlays because information regarding the distribution of federal expenditures across states is not generally available.

Because the Census expenditure data are not continuous from 1932 to 1952 it is necessary to make some assumptions regarding the available direct expenditure data in order to complete the expenditure series. Adjustments made to the data are described below, followed by the methodology used to calculate capital stocks.

### **Expenditure Data**

Apogee obtained from the Bureau of the Census, through the Advisory Commission on Intergovernmental Relations (ACIR), Government Finances national historical expenditure data. These data contain a continuous annual series of capital outlay and construction expenditures from 1952 through 1990. Total direct expenditure data are available for years prior to 1952 on a discontinuous basis: 1902, 1913, 1922, 1927, and every other year from 1932 through 1952 (i.e., 1932, 1934,..., 1952).

To obtain a sufficient time series to calculate capital stocks, direct expenditures for the "missing" years (i.e., 1933, 1935,..., 1951) are interpolated, based upon the implicit growth rate in expenditures of the surrounding years (e.g., 1933 direct expenditure is approximated by multiplying the 1932 expenditure amount by the geometric growth rate from 1932 to 1934). Direct expenditures for years prior to 1932 are not approximated in this way because the number of years with actual data become farther apart, and the assumption of a constant relationship between capital outlays and direct expenditures, and construction and capital outlays becomes more tenuous.



Capital outlays are assumed to follow the same annual growth rates as direct expenditures, and remain a constant proportion of direct expenditures. This constant proportion is based upon the 1952 ratio of capital outlay to direct expenditures. Similarly, construction expenditures are assumed to follow the growth rate in capital outlays, in constant proportion to the 1952 value. The data were examined to insure that 1952 was not a particularly different year from subsequent years. Establishing the data series in this way imposes the same year to year growth rate on capital outlays and construction as direct expenditures, with the respective expenditure level benchmarked to the 1952 value. Exceptions to this procedure for air transportation, water transport and terminals, sewerage and solid waste management are provided in Appendix II-1.

### Capital Stock Methodology

The resulting state and local government capital outlay and construction expenditure data are used to construct each infrastructure capital stock from 1932 through 1990. The perpetual inventory method is applied to accumulate constant dollar investment flows. For each mode, the following are calculated:

- Gross Capital Stock;
- Net Capital Stock;
- Cumulative Retirements; and
- Annual Decay.

Gross capital stock is defined as the difference between the accumulated investment flow, in constant dollars, and accumulated retirements. Net stock is the difference between gross stock and annual decay. Retirements are assumed to follow a truncated bell-shaped curve, with the truncation at 45 percent and 155 percent of an asset's average useful life, as calculated by the Bureau of Economic Analysis.<sup>5</sup> Retirements and decay do not take affect until the year after the initial year of investment. The combination of retirements, or discards, and decay are referred to as deterioration.<sup>6</sup>

Decay is assumed to follow either a straight-line or an economic efficiency path. A separate capital stock series is calculated for each mode and decay assumption. Straight-line decay assumes a constant proportion,  $1/T$ , of the initial investment decays for each year of the asset's life, where  $T$ =asset life.

Economic, or efficiency, decay is calculated as:  $(T-t)/(T-\beta t)$ , where  $T$ =asset life;  $t$ =years from initial investment; and  $\beta$  is an economic efficiency factor. The lower the value of  $\beta$ , the more rapid is the decline in the quantity of services delivered by the asset. This relationship represents "the decline in efficiency (in terms of productive service units of the capital) with any uniform level of maintenance over the life of the capital."<sup>7</sup> A value of  $\beta=0.9$  is assumed here.

Under both economic and straight-line patterns, the initial asset value decays over the same length of time. However, economic decay, as specified, deducts a smaller proportion of the initial investment in the early years of the asset's life relative to straight-line decay. Aside from the above assumptions, highway and non-highway stocks are constructed somewhat differently, as described below.

Non-Highway Modes. A distinction is made between outlays for structures and outlays for equipment. Outlays for structures are approximated by construction expenditures, and outlays for equipment by non-construction expenditures (defined as capital outlays less construction expenditures). This allows the contributions to total capital stock to vary over time by type of capital outlay.

The Engineering News Record (ENR) Construction Index, base year 1987, is used to deflate all non-highway construction outlays. The Producer Price Index (PPI) for Finished Goods, Capital Equipment, base year 1987, is used to deflate equipment (non-construction) expenditures.<sup>8</sup>

The Bureau of Economic Analysis (BEA) asset life estimates for nonresidential, state and local government equipment and structures are used in both decay assumptions: 15 years for equipment; and 50 years for structures.<sup>9</sup>

Highways. Based upon the work of Bell and McGuire, the assumptions regarding the distribution of capital expenditures and average lives are the following:<sup>10</sup>

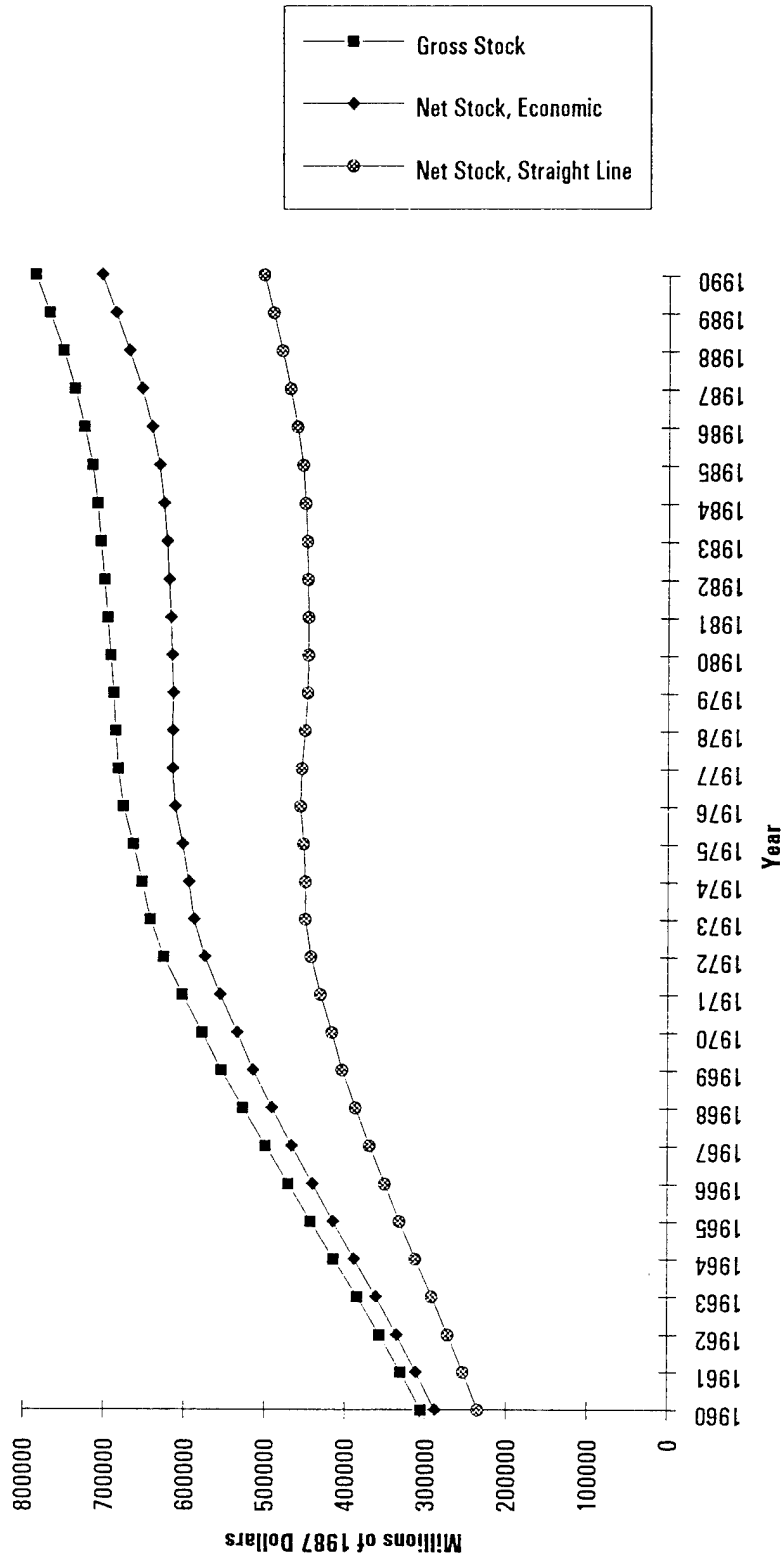
- Paving is 52 percent of capital outlays, with an average life of 14 years;
- Grading is 26.5 percent of capital outlays, with an average life of 80 years; and
- Structures are 21.5 percent of capital outlays, with an average life of 50 years.

The Federal Highway Administration's construction indexes for surfacing, excavation, and structures are used to deflate paving, grading, and structure expenditures, respectively, to 1987 dollars.

### **National Capital Stock Results**

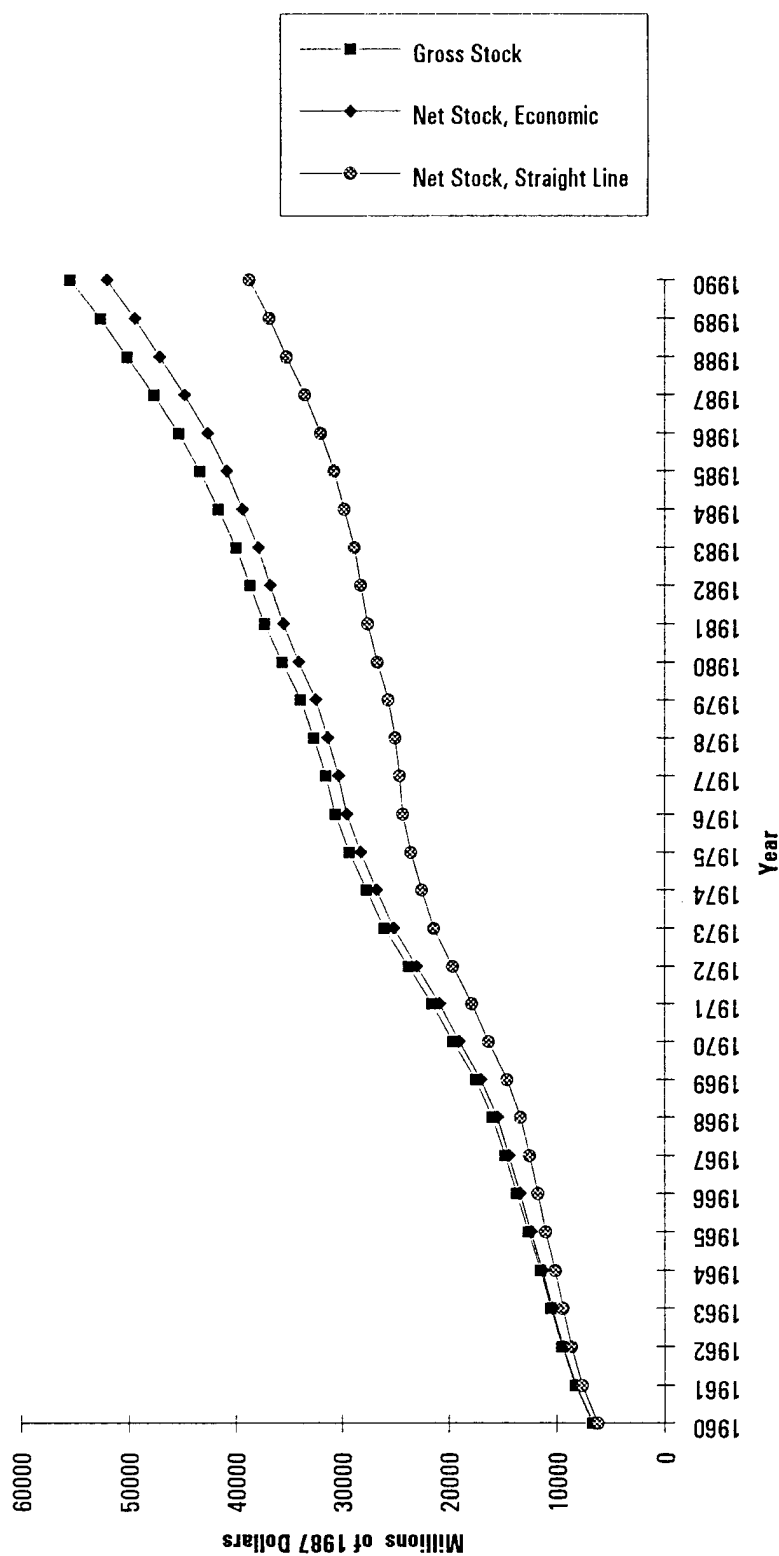
The results of these calculations, for each infrastructure mode, are presented graphically in Figures 2-1 through 2-7. Each figure displays, from 1960 through 1990, gross and net stocks in millions of 1987 dollars. The net stocks obtained under the two decay assumptions are presented together for comparison. The figures clearly indicate that the level of stock using straight-line decay is below that of economic decay, although they tend to follow similar paths with similar inflection points. The exception to this is water transport and terminals (Figure 2-7),





Source: Apogee Research from Census data

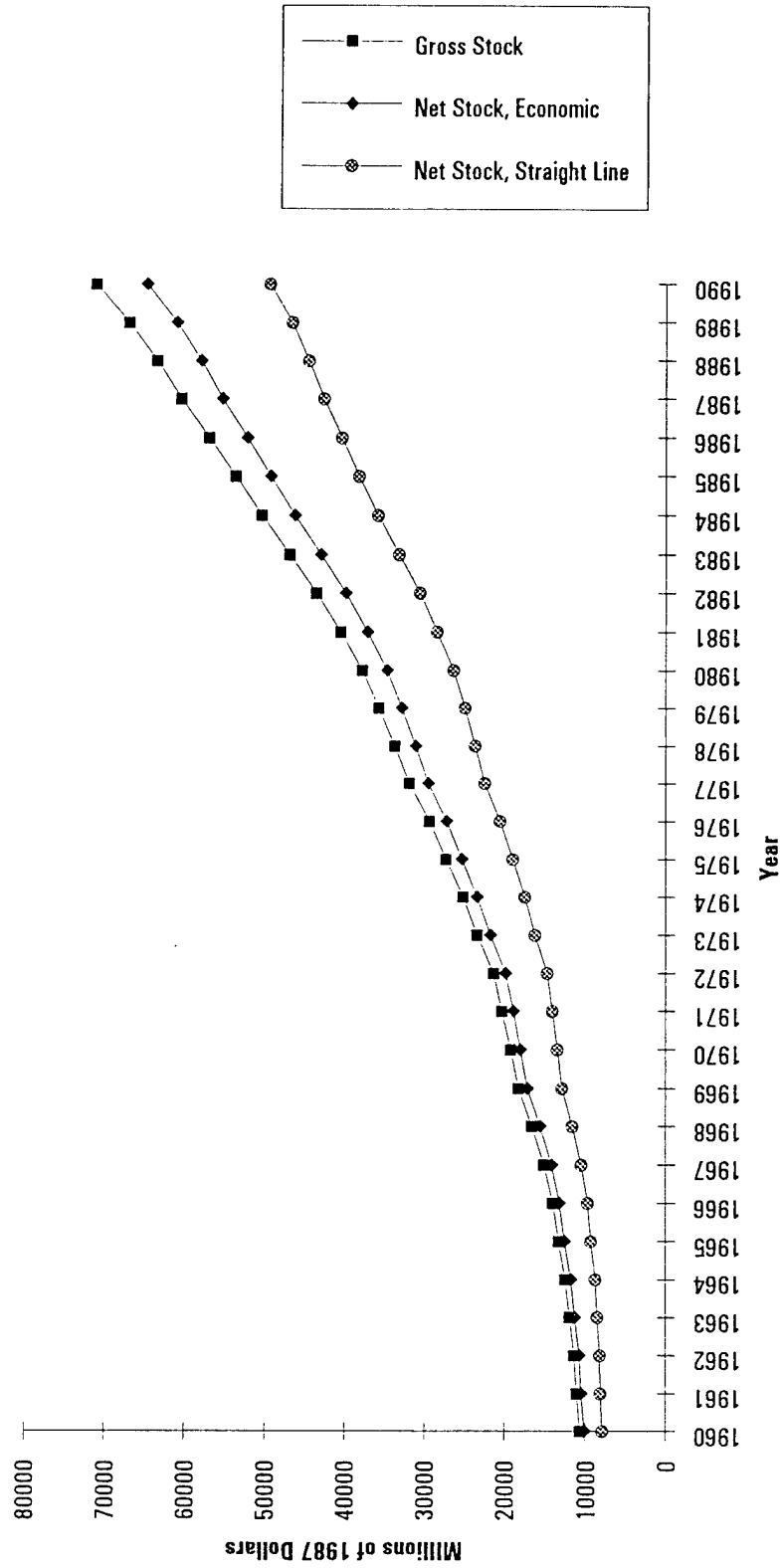
Figure 2.1: State and Local Highway Capital Stock



Source: Apogee Research from Census data

Figure 2:2: State and Air Transportation Capital Stock

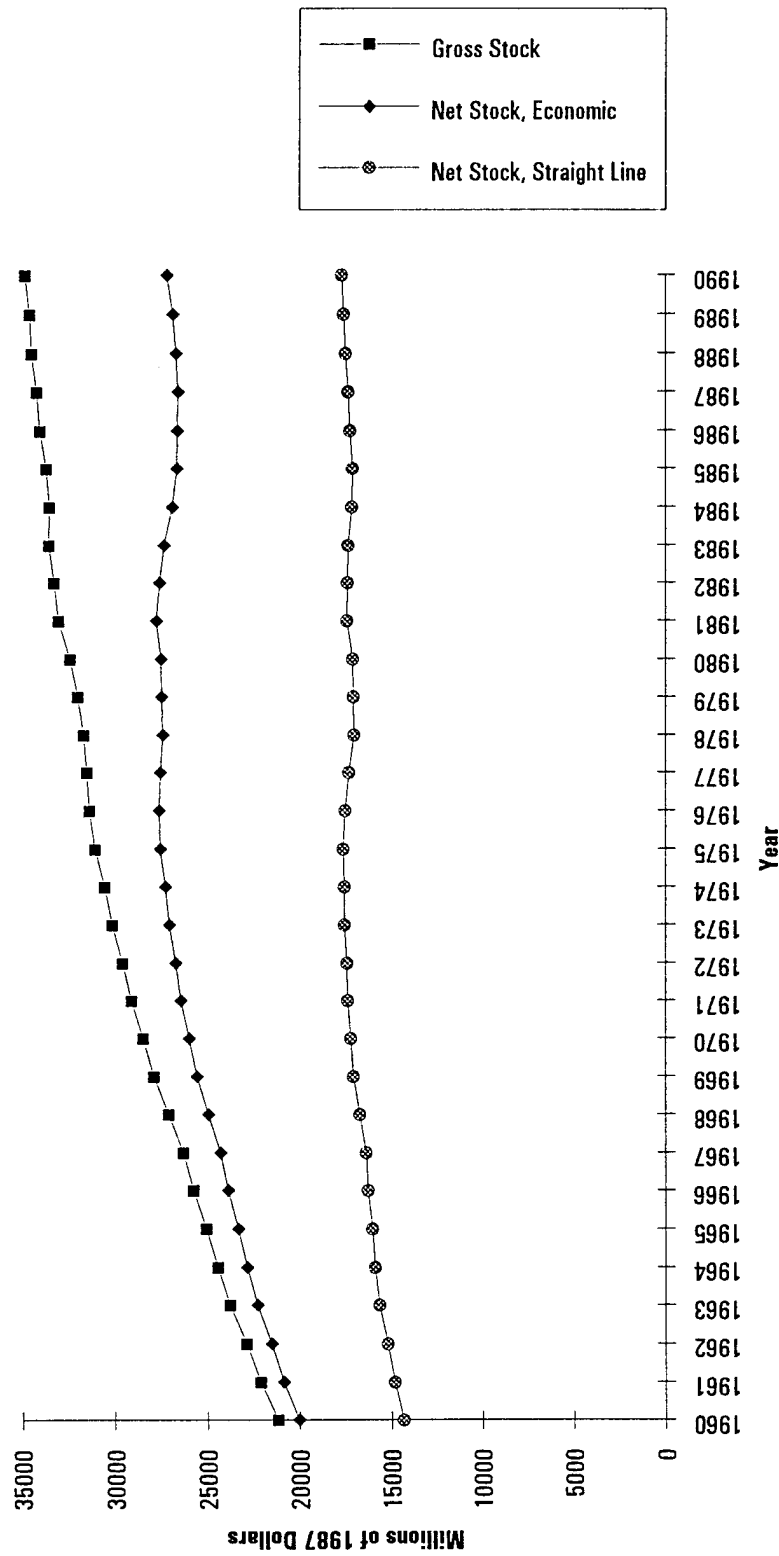




Source: Apogee Research from Census data

Figure 2.3: State and Local Mass Transit Capital Stock

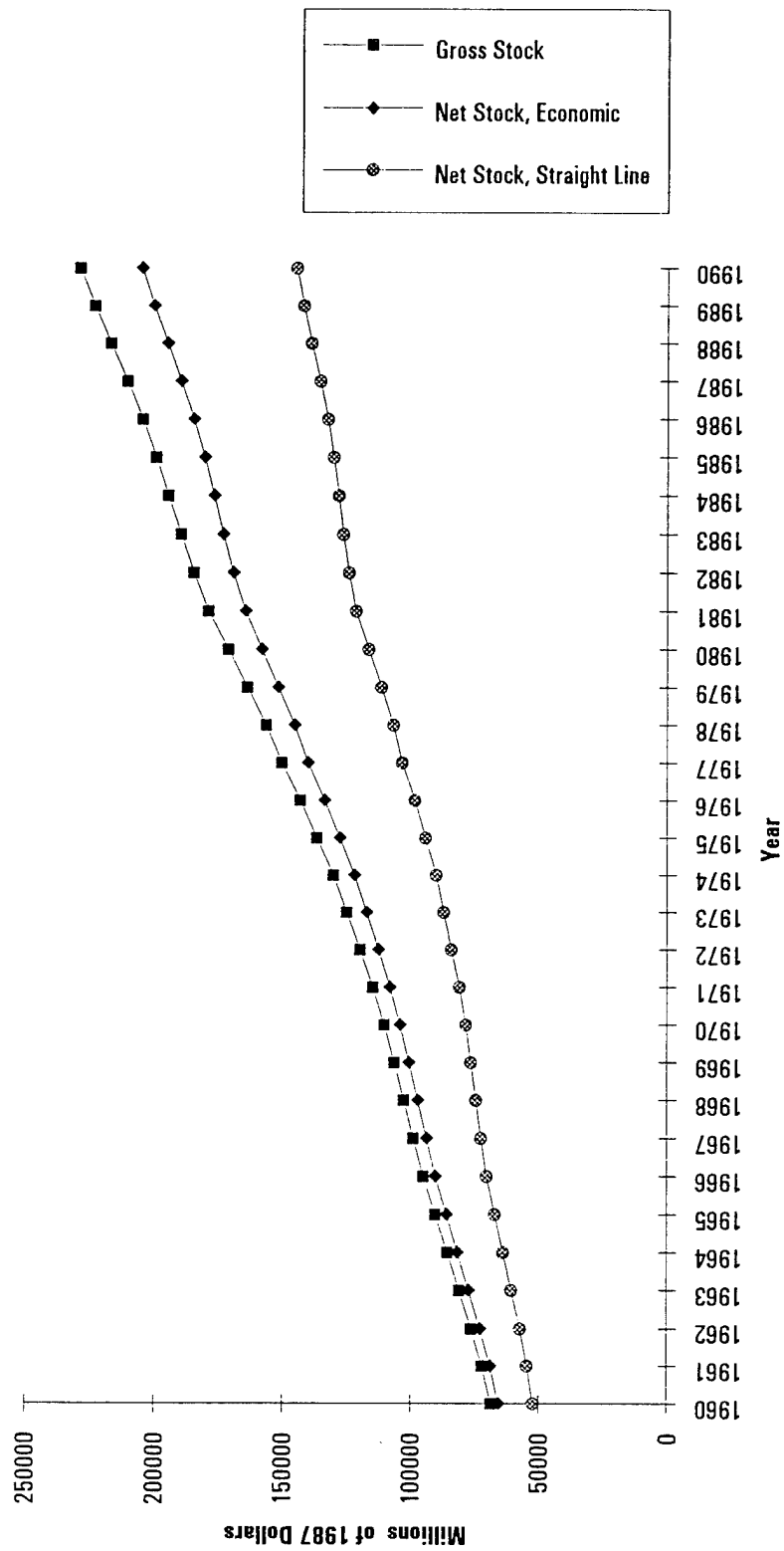




Source: Apogee Research from Census data

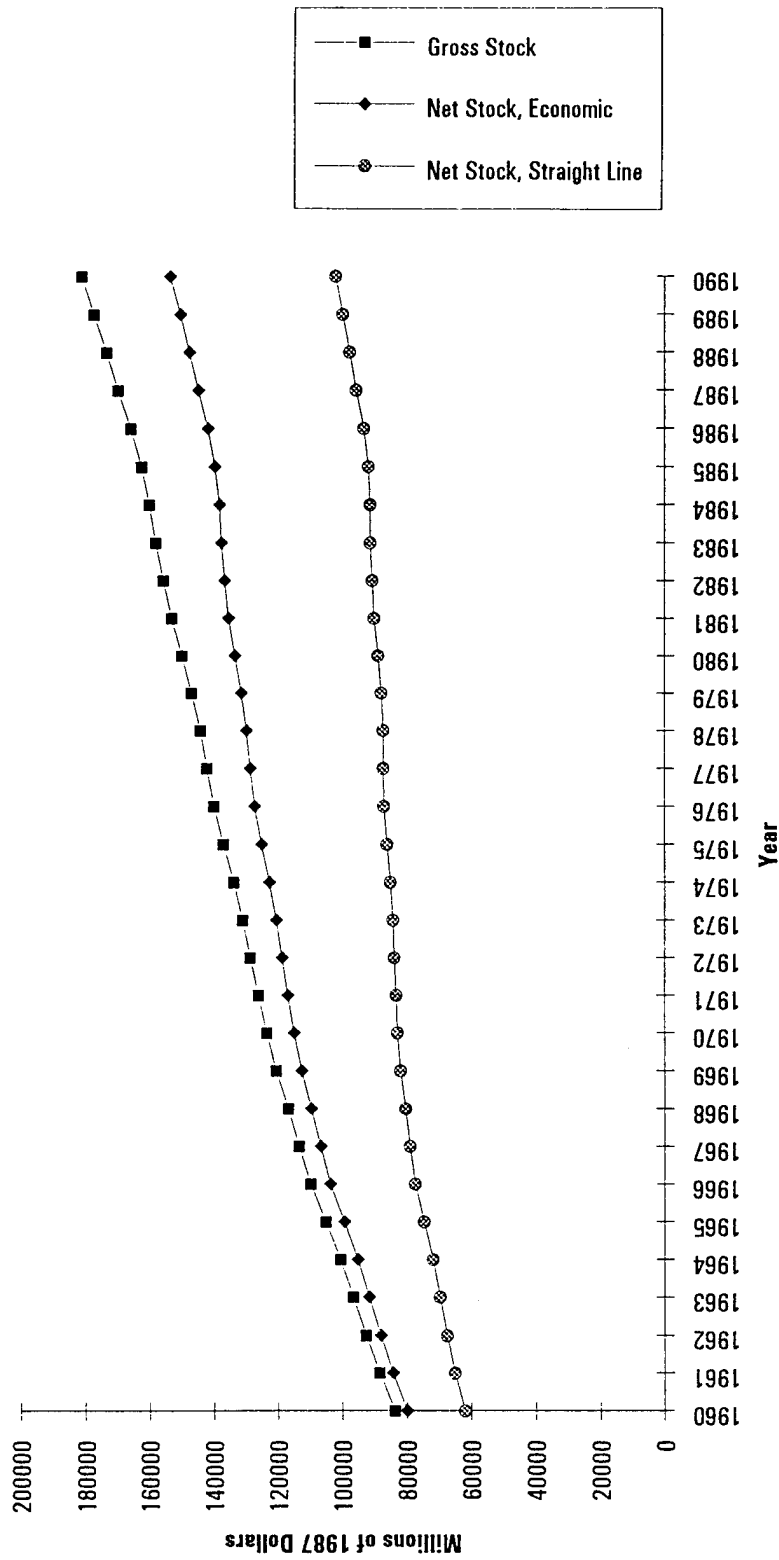
Figure 2:4: State and Local Water Transport and Terminals Capital Stock





Source: Apogee Research from Census data

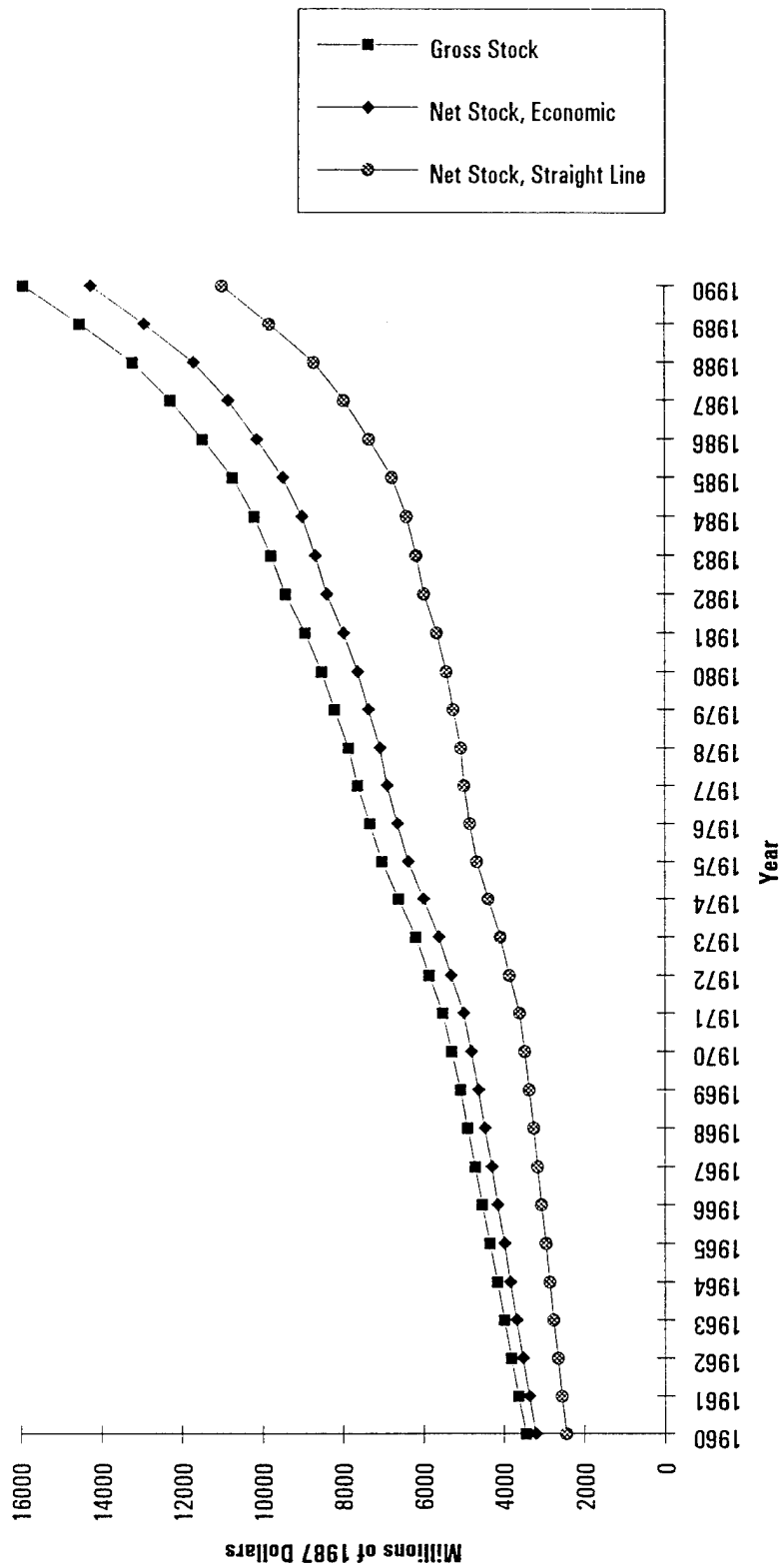
Figure 2.5: State and Local Sewerage Capital Stock



Source: Apogee Research from Census data

Figure 2-6: State and Local Water Supply Capital Stock





Source: Apogee Research from Census data

Figure 2:7: State and Local Waste Management Capital Stock

which indicates relatively stagnant growth in capital stock under straight-line decay, while the net stock value actually declines under economic decay.

Figure 2-8 compares national net highway stocks calculated by Apogee to the BEA's state and local net highways and streets stock.<sup>11</sup> BEA's values appear most closely aligned with the level of the economic decay pattern. This may be largely due to different starting points incorporated into each calculation; because Apogee's values begin accumulating investment flows in 1932, economic decay allows for the level of net assets to "catch up" to the BEA values over time. A comparison of BEA's gross stock to Apogee's for this category, while not presented here, shows a wider gap between the two.

The following table compares average annual growth rates in net state and local government stock for each category from 1985 through 1990:

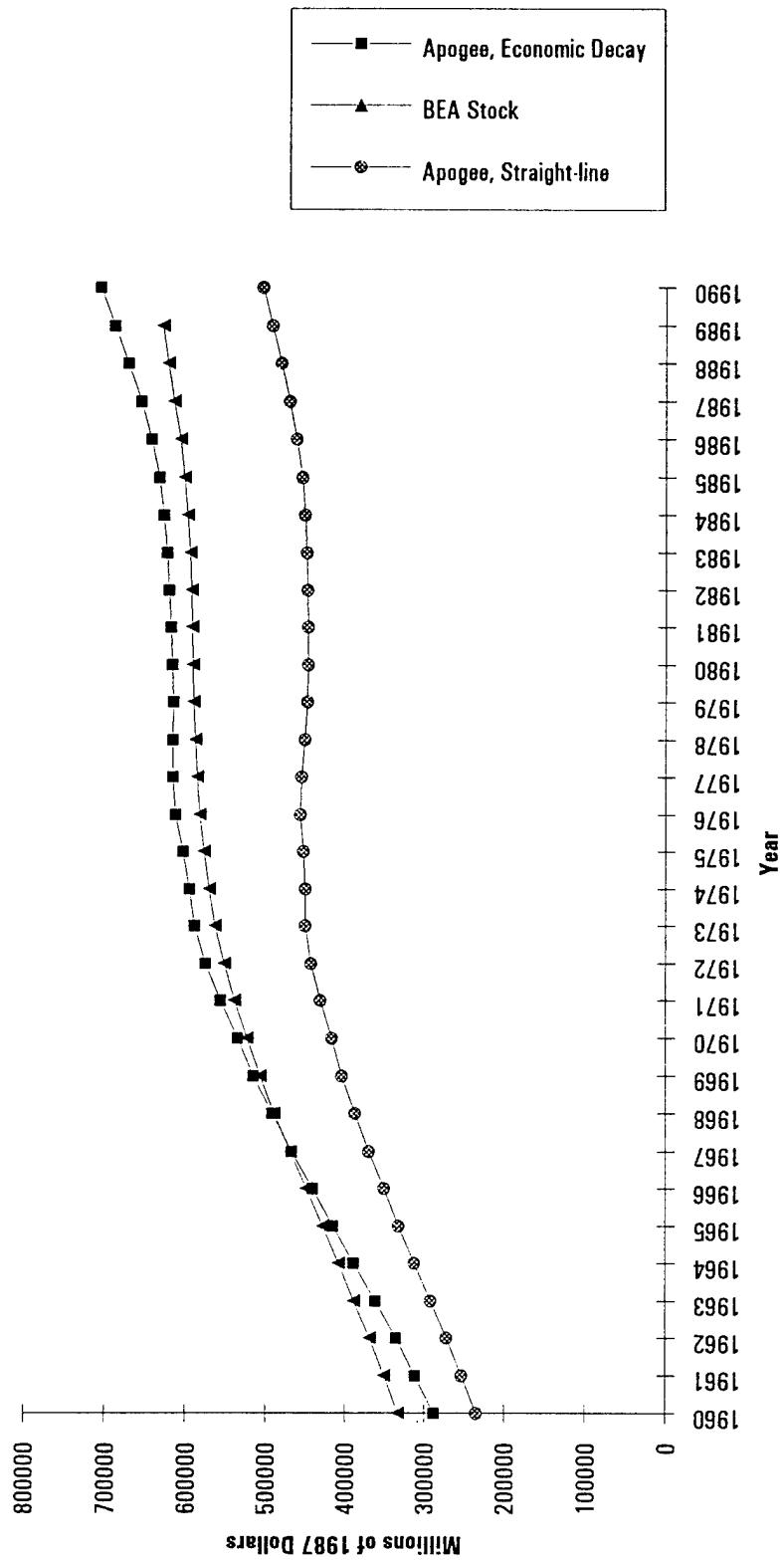
<u>Category</u>	<u>Decay Pattern</u>	
	<u>Straight-Line</u>	<u>Economic</u>
Highways	2.046	2.171
Air Transportation	4.704	4.945
Mass Transit	5.239	5.585
Water Transport and Terminals	0.674	0.378
Sewerage	2.124	2.550
Water Supply	2.112	1.913
Solid Waste Management	10.147	8.521

The two decay patterns arrive at different annual growth rates, yet are not consistently above or below one another. For comparison, the average annual rate of growth in both Gross National Product and Gross Domestic Product of Nonfinancial Corporate Business was 2.8 percent (1987 dollars) over this same time period.

Relating net stock to gross stock indicates a wide gap between the two decay patterns in the level of capital stock. The table below presents the average percentage, from 1985 to 1990, that the level of net stock is of gross stock. The gross stock is independent of the decay assumption, and therefore the same for each.

<u>Category</u>	<u>Decay Pattern</u>	
	<u>Straight-Line</u>	<u>Economic</u>
Highways	63.6	88.9
Air Transportation	70.6	94.0
Mass Transit	70.6	91.4
Water Transport and Terminals	50.8	77.9
Sewerage	64.6	90.0





Source: Apogee Research and Bureau of Economic Analysis

Figure 2:8: Net State and Local Highway Capital Stock

Water Supply	56.5	85.3
Solid Waste Management	64.8	88.7

Thus, included in the debate over the relationship of public capital stock to economic productivity is the sensitivity of the results to the level and rate of growth of public capital. A description of the files containing these capital stocks is provided in Appendix II-2.

### **Federal Highway Administration**

In addition to highway expenditure information available from Census, we obtained capital outlays, by all levels of government from 1921 through 1992, from the Federal Highway Administration. As this is a continuous series, no adjustments were made to these data. Following the same methodology and assumptions described above for highways, national level highway capital stock was constructed using both straight-line and economic efficiency decay patterns. The trends are similar to those found above, although the stock levels are somewhat higher due to the longer time period over which to accumulate investment flows, and the inclusion of federal capital outlays. The files containing these data are described in Appendix II-2.

### **STATE PUBLIC CAPITAL STOCK**

Public capital stocks at the state level are constructed from different sources: Census Government Finances; Federal Highway Administration; and U.S. Army Corps of Engineers expenditure data. Census data allow construction of state and local government capital for the following infrastructure categories:

- Highways;
- Air Transportation;
- Mass Transit;
- Water Transport and Terminals;
- Sewerage;
- Water Supply; and
- Solid Waste Management.

Federal capital outlays for air transportation are not available on a state by state basis from the FAA. Therefore, state level capital stock for air transportation is currently provided based only upon state and local government capital expenditures.

Water transport and terminals captures the state and local government contribution of the broader category of water resources.<sup>12</sup> The Corps expenditure data provide the federal contribution to the water resources category. Expenditure data from FHWA allow construction of an additional highway capital stock, covering a longer time period. The combination of



capital stocks based upon Census, FHWA, and Corps data provides a comprehensive set of infrastructure information at the state level.

### Census, Government Finances

Because Census data at the state level for the above infrastructure categories is available only from 1977 through 1990, a different procedure from that used for the national capital stocks is required to implement the perpetual inventory method. The methodology to obtain state specific capital stocks from the Census data is based upon the recent work of Douglas Holtz-Eakin.<sup>13</sup>

The perpetual inventory method of capital accumulation can be presented as follows:

$$K_t = (1-\delta)K_{t-1} + I_t; \quad (1)$$

where  $K_t$  is the capital stock in year  $t$ ;  $I_t$  is the capital outlay in year  $t$ ; and  $\delta$  is the constant annual deterioration rate, inclusive of both retirements and decay.

Application of equation (1) to each state's investment flow, beginning in 1977, requires a deterioration rate, and a 1976 benchmark capital stock. State specific 1976 benchmark capital stocks are obtained by allocating Apogee's estimated 1976 national capital stocks to each of the 50 states and the District of Columbia, based upon each state's share of total direct expenditure relative to the U.S. total direct expenditure, for each mode. Direct expenditures include capital outlays and operations and maintenance, and reflect the general level of activity within each state and infrastructure mode.

Table 2-1 presents the individual state shares of total direct expenditure, expressed as percentages. The shares represent the 1977 through 1980 average percentage for each state. This time period is used to reduce the variation of a specific year, and to exclude the 1980's, a period over which much of the discussion of declining infrastructure has taken place.<sup>14</sup>

The deterioration rate,  $\delta$ , for each investment mode, is obtained as the solution to the following equation:<sup>15</sup>

$$K_{1990} = (1-\delta)^{14}K_{1976} + \sum_0^{13} (1-\delta)^i I_{1990-i}; \text{ where} \quad (2)$$

$K_{1990}$  is the Apogee estimated national capital stock in 1990;

$K_{1976}$  is the Apogee estimated national capital stock in 1976; and

$I_{1990-i}$  is the national investment flow in year 1990- $i$ , for  $i=0$  to 13.



**TABLE 2-1**  
**% SHARES OF NATIONAL STATE & LOCAL DIRECT EXPENDITURES**

	State	Highway	Mass Transit	Air Transp	Water Supply	Water Trans	Waste Mgmt	Sewer
1	Alabama	1.78	0.15	0.73	1.61	4.17	1.71	0.99
2	Alaska	0.73	0.08	2.22	0.30	1.45	0.41	0.40
3	Arizona	1.30	0.12	2.27	1.34	0.02	1.56	0.80
4	Arkansas	1.16	0.04	0.47	0.80	0.04	0.63	0.33
5	California	6.76	11.21	11.54	15.99	18.63	8.21	9.67
6	Colorado	1.41	0.98	2.15	3.04	0.06	0.68	1.24
7	Connecticut	1.09	0.74	0.34	0.52	0.05	1.32	1.59
8	Delaware	0.28	0.10	0.08	0.11	0.60	0.27	0.43
9	District of Columbia	0.23	10.62	0.00	0.34	0.00	0.87	0.77
10	Florida	3.36	1.39	5.70	4.99	4.12	5.58	4.86
11	Georgia	2.41	4.67	4.96	2.80	4.32	2.61	1.32
12	Hawaii	0.46	0.42	2.51	0.62	1.68	0.46	0.65
13	Idaho	0.59	0.02	0.36	0.26	0.01	0.28	0.17
14	Illinois	5.34	6.77	5.00	5.12	0.87	5.27	6.65
15	Indiana	2.08	0.30	1.23	1.22	0.52	1.26	1.93
16	Iowa	2.23	0.24	0.73	1.04	0.02	0.90	1.17
17	Kansas	1.56	0.05	1.28	1.44	0.10	0.73	0.70
18	Kentucky	2.53	0.43	1.02	1.34	0.25	1.10	1.09
19	Louisiana	2.48	0.11	0.98	1.20	5.82	2.06	0.94
20	Maine	0.67	0.09	0.37	0.55	0.07	0.27	0.52
21	Maryland	1.99	1.55	1.75	1.88	3.16	2.72	2.38
22	Massachusetts	2.13	7.00	1.88	2.14	3.54	2.58	2.45
23	Michigan	3.73	2.41	3.54	4.07	0.69	4.00	5.20
24	Minnesota	2.68	1.03	1.60	1.43	2.55	0.85	2.45
25	Mississippi	1.46	0.00	0.66	0.65	0.80	0.92	0.30
26	Missouri	2.19	1.68	2.18	1.39	0.04	1.13	1.86
27	Montana	0.76	0.01	0.70	0.29	0.00	0.31	0.18
28	Nebraska	1.11	0.14	0.76	0.65	0.03	0.42	0.64
29	Nevada	0.53	0.00	1.67	0.76	0.01	0.08	0.32
30	New Hampshire	0.59	0.00	0.06	0.20	0.07	0.23	0.37
31	New Jersey	2.41	0.50	0.26	1.99	0.67	3.32	4.80
32	New Mexico	0.77	0.09	0.45	0.66	0.01	0.58	0.31
33	New York	6.68	32.05	13.94	5.51	7.31	16.43	10.72
34	North Carolina	2.29	0.25	1.32	2.18	1.19	2.63	1.45
35	North Dakota	0.61	0.01	0.64	0.35	0.00	0.22	0.22
36	Ohio	3.88	2.30	3.20	3.84	0.71	3.91	6.78
37	Oklahoma	1.35	0.13	1.57	1.39	0.10	1.07	0.85
38	Oregon	1.29	0.92	0.50	2.08	8.39	0.40	1.30
39	Pennsylvania	4.15	6.18	3.15	2.92	0.41	4.78	5.45
40	Rhode Island	0.26	0.20	0.27	0.27	0.05	0.35	0.55
41	South Carolina	0.85	0.00	0.52	1.02	2.48	1.32	0.73



**TABLE 2-1 (cont.)**

	State	Highway	Mass Transit	Air Transp	Water Supply	Water Trans	Waste Mgmt	Sewer
42	South Dakota	0.60	0.00	0.34	0.28	0.03	0.15	0.13
43	Tennessee	2.10	0.50	1.75	2.47	0.03	2.35	1.38
44	Texas	5.90	1.20	7.20	9.71	8.53	5.68	5.67
45	Utah	0.71	0.31	0.92	0.64	0.00	0.42	0.33
46	Vermont	0.33	0.00	0.12	0.12	0.00	0.06	0.13
47	Virginia	3.07	0.46	0.79	2.48	1.14	2.35	2.36
48	Washington	2.29	1.64	1.96	1.90	14.96	1.77	1.65
49	West Virginia	1.68	0.09	0.43	0.45	0.01	0.52	0.32
50	Wisconsin	2.65	0.82	1.57	1.31	0.23	2.10	2.40
51	Wyoming	0.51	0.00	0.38	0.34	0.05	0.19	0.12
=====								
	Total	100	100	100	100	100	100	100

Source: Apogee Research from Census data.

Note: Each share represents the average share from 1977 to 1980, expressed as a percent. Due to rounding, column totals may not add to 100.

The  $\delta$  is assumed constant for each year, across all states. The 1976 through 1990 period was chosen for this calculation in order that the resulting national deterioration rates reflect the time period over which the state capital stocks are estimated. The annual investment flow is the sum of real construction expenditures (structures) and real non-construction expenditures (equipment), as described previously.

The resulting deterioration rates capture the average geometric rate over the time period for which the state level capital stocks are calculated, and requires that the sum of the state stocks equal the national stock in 1990. Calculated in this way, the rate is independent of the method used to allocate the benchmark.

Deterioration rates for each mode using both the straight-line and economic decay-based capital stock values are presented below, expressed as percentages:

<u>Infrastructure Category</u>	<u>Straight-Line Decay</u>	<u>Economic Decay</u>
Highways	4.520272	2.759395
Air Transportation	3.343884	1.047239
Mass Transit	4.668248	2.120363
Water Transport and Terminals	4.552991	3.081864
Sewerage	3.359767	1.371290
Water Supply	4.021272	2.091871
Solid Waste Management	5.691467	2.986453

The annual deterioration rates based upon straight-line decay are greater than those of economic decay. The simple average of the above rates is 4.3 percent for straight-line decay, and 2.2 percent for economic decay. The average straight-line rate is in line with the overall 4.1 percent obtained by Holtz-Eakin.

Tables 2-2 through 2-8 present, for each mode, the 1985 and 1990 capital stock for each state, based upon straight-line decay, and the average annual percentage growth rate from 1985 through 1990. The states are ranked according to their 1985 level of capital stock, shown in millions of 1987 dollars. A description of the files containing these values is provided in Appendix II-3.



**TABLE 2-2**  
**STATE AND LOCAL NET HIGHWAY CAPITAL STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	New York	30240	33692	2.18
2	Texas	30050	35761	3.54
3	California	29783	31389	1.06
4	Illinois	24891	26657	1.38
5	Ohio	17526	18444	1.03
6	Pennsylvania	17273	19146	2.08
7	Florida	17063	20485	3.72
8	Michigan	16057	15853	-0.26
9	Virginia	13530	15056	2.16
10	Louisiana	12383	12674	0.47
11	Minnesota	12336	13726	2.16
12	Kentucky	12014	11863	-0.25
13	Georgia	11889	13317	2.29
14	Wisconsin	11311	11523	0.37
15	Washington	11246	11675	0.75
16	New Jersey	10911	14224	5.44
17	North Carolina	10015	10552	1.05
18	Maryland	9945	11617	3.16
19	Iowa	9915	10084	0.34
20	Missouri	9841	10339	0.99
21	Tennessee	9659	10565	1.81
22	Indiana	9289	9637	0.74
23	Massachusetts	8844	9157	0.70
24	Alabama	8131	8318	0.46
25	West Virginia	7572	7161	-1.11
26	Kansas	7158	7571	1.13
27	Mississippi	6675	6581	-0.28
28	Arizona	6614	9585	7.70
29	Colorado	6463	7271	2.38
30	Oklahoma	6227	6678	1.41
31	Oregon	6008	6316	1.00
32	Nebraska	5180	5348	0.64
33	Arkansas	5018	5052	0.14
34	Connecticut	4780	6406	6.03
35	Alaska	3937	4258	1.58
36	New Mexico	3916	4484	2.75
37	Utah	3641	4000	1.90
38	South Carolina	3598	4304	3.65

TABLE 2-2 (cont.)

Rank	State	1985	1990	Annual Growth (%)
39	Montana	3563	3670	0.59
40	Wyoming	2872	3110	1.60
41	North Dakota	2860	2854	-0.04
42	Idaho	2797	3067	1.86
43	Maine	2742	2711	-0.23
44	South Dakota	2671	2730	0.44
45	Nevada	2604	3065	3.32
46	New Hampshire	2489	2561	0.57
47	Hawaii	2146	2170	0.23
48	Vermont	1388	1418	0.44
49	Delaware	1342	1658	4.32
50	Rhode Island	1204	1583	5.64
51	District of Columbia	1015	1197	3.36
		=====	=====	=====
	Total	460622	502563	2.05

Source: Apogee Research

Note: Values in millions of 1987 dollars; straight-line decay



**TABLE 2-3**  
**STATE AND LOCAL NET AIR TRANSPORTATION CAPITAL STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	California	3436	3926	2.70
2	New York	3228	3756	3.08
3	Texas	2589	3067	3.45
4	Florida	2316	3654	9.54
5	Georgia	1656	1695	0.47
6	Illinois	1402	2257	10.00
7	Ohio	956	1023	1.38
8	Michigan	915	1037	2.54
9	Alaska	836	904	1.57
10	Pennsylvania	811	1021	4.72
11	Nevada	776	977	4.72
12	Arizona	761	1001	5.64
13	Hawaii	760	1031	6.29
14	Missouri	757	902	3.58
15	Colorado	749	1126	8.48
16	Tennessee	603	1051	11.76
17	Washington	532	583	1.85
18	Oklahoma	526	617	3.23
19	Wisconsin	520	606	3.12
20	Minnesota	520	691	5.85
21	North Carolina	497	875	11.98
22	Massachusetts	491	602	4.16
23	Maryland	461	556	3.82
24	Indiana	354	489	6.65
25	Louisiana	332	424	4.99
26	Kansas	331	316	-0.92
27	Kentucky	329	482	7.98
28	Utah	322	409	4.91
29	Nebraska	249	358	7.51
30	Virginia	234	393	10.93
31	Alabama	206	273	5.85
32	Iowa	203	253	4.46
33	Montana	197	190	-0.69
34	Oregon	188	300	9.86
35	North Dakota	183	194	1.14
36	Mississippi	167	159	-0.88
37	New Mexico	148	291	14.40
38	South Carolina	147	209	7.23

**TABLE 2-3 (cont.)**

Rank	State	1985	1990	Annual Growth (%)
39	Arkansas	130	147	2.45
40	Idaho	117	117	0.03
41	Wyoming	116	113	-0.44
42	West Virginia	111	109	-0.40
43	Maine	99	107	1.43
44	South Dakota	99	110	2.20
45	Connecticut	85	90	1.18
46	Rhode Island	69	79	2.60
47	New Jersey	67	80	3.43
48	Vermont	33	49	8.21
49	Delaware	26	25	-0.64
50	New Hampshire	17	23	6.96
51	District of Columbia	0	0	.
		=====	=====	=====
	Total	30657	38747	4.70

Source: Apogee Research

Note: Values in millions of 1987 dollars; straight-line decay



**TABLE 2-4**  
**STATE AND LOCAL NET MASS TRANSIT CAPITAL STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	New York	11026	16749	8.72
2	District of Columbia	4775	4849	0.31
3	California	3415	4589	6.09
4	Massachusetts	3390	4344	5.09
5	Georgia	2526	2579	0.42
6	Illinois	1906	1926	0.21
7	Pennsylvania	1874	2156	2.84
8	Florida	1359	1438	1.14
9	Maryland	863	1059	4.18
10	New Jersey	769	1678	16.88
11	Texas	765	1336	11.79
12	Ohio	741	754	0.37
13	Washington	528	1042	14.57
14	Michigan	515	468	-1.86
15	Missouri	447	546	4.09
16	Oregon	421	468	2.14
17	Colorado	362	429	3.48
18	Connecticut	333	533	9.88
19	Wisconsin	290	385	5.84
20	Minnesota	194	215	2.01
21	Indiana	157	165	1.02
22	Tennessee	117	136	3.16
23	Kentucky	112	125	2.28
24	Utah	110	132	3.77
25	Virginia	108	121	2.27
26	Hawaii	107	149	6.87
27	Louisiana	84	143	11.15
28	Iowa	84	84	0.01
29	Arizona	82	110	5.99
30	Nebraska	76	83	1.75
31	North Carolina	69	93	6.12
32	Rhode Island	46	83	12.53
33	Oklahoma	39	43	1.89
34	New Mexico	31	38	3.86
35	Delaware	26	34	5.59
36	Alabama	23	24	0.17
37	Alaska	23	23	0.30
38	Maine	22	18	-4.36



TABLE 2-4 (cont.)

Rank	State	1985	1990	Annual Growth (%)
39	West Virginia	20	22	2.07
40	Kansas	10	12	2.93
41	Arkansas	8	11	4.95
42	Montana	7	7	-0.92
43	North Dakota	7	6	-2.74
44	Idaho	6	6	0.89
45	South Dakota	5	5	-0.52
46	South Carolina	3	11	27.05
47	Mississippi	1	3	35.55
48	New Hampshire	0	0	1.54
49	Nevada	0	3	.
50	Wyoming	0	0	.
51	Vermont	0	0	.
		=====	=====	=====
	Total	37882	49233	5.24

Source: Apogee Research

Note: Values in millions of 1987 dollars; straight-line decay



**TABLE 2-5**  
**STATE AND LOCAL NET WATER TRANSPORT & TERMINALS STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	California	3541	3737	1.09
2	Washington	2387	2313	-0.63
3	Texas	1343	1318	-0.37
4	Oregon	1245	1152	-1.54
5	New York	1152	1335	2.99
6	Louisiana	1070	943	-2.50
7	Florida	810	1028	4.88
8	Alabama	731	612	-3.49
9	Georgia	727	742	0.41
10	Minnesota	594	653	1.92
11	Massachusetts	531	574	1.54
12	Maryland	489	566	2.97
13	South Carolina	424	416	-0.39
14	Alaska	392	389	-0.14
15	Hawaii	307	314	0.45
16	Virginia	223	383	11.49
17	North Carolina	168	178	1.23
18	Indiana	162	142	-2.53
19	Mississippi	127	123	-0.60
20	Illinois	117	103	-2.59
21	New Jersey	112	110	-0.22
22	Ohio	100	88	-2.59
23	Michigan	97	84	-2.98
24	Delaware	87	85	-0.53
25	Pennsylvania	57	59	0.80
26	Maine	45	63	7.15
27	Wisconsin	40	43	1.77
28	Kentucky	39	34	-2.84
29	Oklahoma	17	15	-1.95
30	Kansas	14	11	-4.28
31	New Hampshire	11	10	-1.47
32	Arkansas	9	10	1.56
33	Rhode Island	8	12	7.86
34	Colorado	8	7	-2.07
35	Missouri	8	11	6.83
36	Wyoming	7	5	-4.55
37	Connecticut	6	6	-0.47
38	Tennessee	5	4	-4.50

**TABLE 2-5 (cont.)**

Rank	State	1985	1990	Annual Growth (%)
39	Iowa	5	4	-2.81
40	Nebraska	4	4	-4.18
41	South Dakota	3	3	-4.55
42	Idaho	3	5	7.40
43	Arizona	3	2	-4.55
44	New Mexico	1	1	-4.55
45	West Virginia	1	1	-4.55
46	Nevada	1	1	-4.55
47	Vermont	1	0	-4.55
48	Utah	0	0	.
49	District of Columbia	0	0	.
50	North Dakota	0	0	.
51	Montana	0	0	.
		=====	=====	=====
	Total	17232	17699	0.67

Source: Apogee Research

Note: Values in millions of 1987 dollars; straight-line decay



**TABLE 2-6**  
**STATE AND LOCAL NET SEWERAGE CAPITAL STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	New York	14580	16148	2.06
2	California	12347	14760	3.63
3	Ohio	8696	9548	1.89
4	Illinois	8505	8585	0.19
5	Texas	7676	9914	5.25
6	Pennsylvania	6476	6386	-0.28
7	New Jersey	5957	6324	1.20
8	Michigan	5937	5730	-0.71
9	Florida	5734	6189	1.54
10	Wisconsin	3433	4070	3.46
11	Massachusetts	3260	4061	4.49
12	Maryland	3224	3448	1.35
13	Minnesota	3060	3171	0.71
14	Virginia	2953	3402	2.87
15	Missouri	2490	2764	2.11
16	Indiana	2455	2683	1.79
17	Washington	2290	2855	4.51
18	Connecticut	2016	2161	1.40
19	Tennessee	1921	2212	2.86
20	Colorado	1699	1862	1.84
21	North Carolina	1648	1655	0.08
22	Georgia	1641	2006	4.10
23	Iowa	1634	1932	3.41
24	Oregon	1579	1661	1.02
25	Arizona	1378	1829	5.82
26	Louisiana	1373	1976	7.56
27	Kentucky	1293	1388	1.43
28	Alabama	1208	1353	2.28
29	Oklahoma	1208	1468	3.98
30	South Carolina	1039	1270	4.09
31	Kansas	1020	998	-0.45
32	District of Columbia	824	837	0.31
33	Hawaii	817	850	0.80
34	Nebraska	784	790	0.16
35	Rhode Island	735	792	1.49
36	Alaska	710	787	2.08
37	Maine	661	782	3.42
38	New Mexico	531	684	5.21

TABLE 2-6 (cont.)

Rank	State	1985	1990	Annual Growth (%)
39	New Hampshire	491	546	2.15
40	Delaware	485	491	0.24
41	West Virginia	476	515	1.61
42	Nevada	443	515	3.07
43	Mississippi	409	565	6.65
44	Utah	405	550	6.30
45	Arkansas	398	501	4.72
46	North Dakota	324	313	-0.70
47	Montana	257	254	-0.23
48	Idaho	245	285	3.04
49	South Dakota	237	250	1.04
50	Wyoming	233	249	1.31
51	Vermont	200	246	4.20
		=====	=====	=====
	Total	129395	144611	2.12

Source: Apogee Research

Note: Values in millions of 1987 dollars; straight-line decay



**TABLE 2-7**  
**STATE AND LOCAL NET WATER SUPPLY CAPITAL STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	California	13690	16555	3.87
2	Texas	9404	10926	3.05
3	Florida	5737	7981	6.83
4	New York	4502	4930	1.83
5	Illinois	4248	4108	-0.66
6	Colorado	3284	3517	1.38
7	Ohio	3153	3254	0.63
8	Michigan	3101	3074	-0.17
9	Georgia	2657	3158	3.51
10	North Carolina	2386	3080	5.24
11	Pennsylvania	2381	2595	1.74
12	Virginia	2365	2487	1.01
13	Tennessee	2300	2403	0.88
14	Massachusetts	1867	1968	1.06
15	Oregon	1817	1646	-1.96
16	Maryland	1745	1698	-0.54
17	Washington	1708	1874	1.87
18	New Jersey	1601	1751	1.82
19	Oklahoma	1453	1482	0.40
20	Alabama	1440	1552	1.50
21	Arizona	1439	1780	4.35
22	Kansas	1334	1310	-0.37
23	Minnesota	1302	1313	0.17
24	Missouri	1184	1252	1.13
25	Wisconsin	1167	1142	-0.44
26	Kentucky	1118	1247	2.22
27	Louisiana	1104	1134	0.53
28	South Carolina	1074	1286	3.67
29	Indiana	918	887	-0.70
30	Nevada	856	867	0.25
31	Iowa	841	842	0.04
32	Arkansas	702	708	0.18
33	Utah	639	760	3.51
34	New Mexico	624	615	-0.31
35	Hawaii	622	717	2.89
36	Alaska	581	696	3.67
37	Nebraska	568	524	-1.62
38	Mississippi	564	587	0.81

**TABLE 2-7 (cont.)**

Rank	State	1985	1990	Annual Growth (%)
39	Maine	507	488	-0.76
40	Connecticut	494	601	3.98
41	West Virginia	439	431	-0.36
42	Wyoming	397	467	3.30
43	District of Columbia	343	413	3.78
44	South Dakota	334	462	6.75
45	North Dakota	307	302	-0.32
46	Montana	266	255	-0.87
47	Idaho	244	226	-1.53
48	Rhode Island	187	184	-0.33
49	New Hampshire	170	199	3.24
50	Vermont	114	118	0.59
51	Delaware	87	89	0.31
		=====	=====	=====
	Total	91365	101941	2.11

Source: Apogee Research

Note: Values in millions of 1987 dollars; straight-line decay



**TABLE 2-8**  
**STATE AND LOCAL NET WASTE MANAGEMENT CAPITAL STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	New York	1323	2406	12.71
2	Florida	610	1347	17.15
3	California	448	580	5.33
4	Texas	381	441	2.98
5	Virginia	228	361	9.62
6	North Carolina	224	331	8.14
7	Ohio	216	241	2.23
8	Illinois	211	220	0.82
9	Maryland	206	232	2.41
10	Georgia	191	279	7.87
11	Pennsylvania	191	319	10.84
12	Michigan	191	303	9.74
13	Wisconsin	189	201	1.23
14	New Jersey	181	404	17.41
15	Tennessee	153	196	5.07
16	Louisiana	132	139	1.02
17	Washington	128	394	25.28
18	Alabama	124	125	0.21
19	Arizona	117	170	7.83
20	Massachusetts	114	182	9.93
21	Alaska	108	96	-2.32
22	South Carolina	101	125	4.27
23	Oklahoma	84	74	-2.50
24	Connecticut	76	375	37.74
25	Missouri	66	68	0.69
26	Mississippi	63	58	-1.43
27	Kentucky	57	57	0.03
28	Minnesota	57	117	15.60
29	Iowa	55	58	1.04
30	Indiana	54	72	5.64
31	Kansas	47	47	-0.09
32	New Mexico	46	60	5.40
33	Arkansas	44	52	3.14
34	Oregon	44	54	4.15
35	District of Columbia	41	35	-3.05
36	Hawaii	39	215	40.67
37	West Virginia	38	37	-0.73
38	Colorado	37	157	33.44



**TABLE 2-8 (cont.)**

Rank	State	1985	1990	Annual Growth (%)
39	Utah	33	37	2.18
40	Maine	32	77	18.88
41	Nebraska	26	31	3.00
42	Wyoming	26	69	21.31
43	Montana	23	25	1.80
44	New Hampshire	17	31	12.17
45	South Dakota	17	17	0.38
46	Idaho	16	19	3.65
47	Rhode Island	16	13	-3.67
48	North Dakota	15	19	4.50
49	Delaware	14	17	4.74
50	Nevada	3	3	0.32
51	Vermont	3	8	25.63
		=====	=====	=====
	Total	6856	10994	10.15

Source: Apogee Research

Note: Values in millions of 1987 dollars; straight-line decay



## **Federal Highway Administration**

The Federal Highway Administration (FHWA) provided capital expenditure data, by all levels of government and by state, from 1957 through 1990. The procedure described above was used to construct net capital stock, by state, over this time period. The national capital stock for 1956 was allocated to each state based upon each state's share of total capital and maintenance outlays in 1957. Deterioration rates, estimated from the national capital stock, over the time period 1957 through 1990, for both straight-line and economic efficiency decay patterns, are 4.65 percent and 2.66 percent, respectively. These values compare favorably with those obtained above using Census data.

State level capital outlays exclude expenditures not assignable to a specific state; therefore, a very slight difference between the national totals and the sum of individual states is present. The trends in capital stock, nationally and by state, are not substantially different from those presented above, and are therefore not shown here. The resulting data files are described in Appendix II-4.

## **U.S. Army Corps of Engineers**

The U.S. Army Corps of Engineers provided Apogee data covering civil works expenditures, by state, from fiscal years 1936 through 1992.<sup>16</sup> The data contain total expenditures for the following functions:

- Navigation;
- Flood Control;
- Multipurpose, including Power; and
- Mississippi River and Tributaries (MR-T).

For each function, expenditures for "new work" and "operations and maintenance" are provided. New work consists primarily of construction, and also includes expenditures for preliminary survey work and other non-structural, non-equipment expenditures. Expenditures are grouped by the Corps based upon each project's primary purpose, even if benefits of that expenditure extend to other categories (e.g., some navigation projects have flood control benefits).

Navigation includes expenditures for two subdivisions, channels and harbors, and inland waterways. Channels and harbors consists primarily of deep draft dredging while inland waterways consists primarily of locks and dams.

Flood control expenditures include the subdivisions local protection, and reservoirs. Local protection includes expenditures on levees and dams. Multipurpose expenditures are primarily for hydro-electric purposes.

Expenditures for the Mississippi River and its tributaries (MR-T) include both navigation and flood control expenditures. Expenditures for this function are made predominantly to eight states: Louisiana; Mississippi; Arkansas; Tennessee; Missouri; Kentucky; Iowa; and Illinois. The "rule of thumb" applied by the Corps is 75 percent of MR-T expenditures are for flood control, with the remaining 25 percent for navigation.

These data provide the most complete source of federal water resources expenditures on a state basis, and are used to construct capital stocks for the following five categories:

- Navigation:  
Excluding MR-T; and  
MR-T only.
- Flood Control:  
Excluding MR-T; and  
MR-T only.
- Multipurpose, including Power.

Because of the long time period of expenditure flows available, capital stocks are constructed in the same manner as the national level stocks based upon Census data, described previously.

For internal planning purposes, the Corps assumes an asset life of 50 years for each group: channels and harbors; inland waterways; local protection; and reservoirs. This is consistent with the BEA assumption of 50 years for public nonresidential structures. As there is no difference in assumed asset life, separate capital stocks for each of the subcategories are not constructed.<sup>17</sup>

Construction of capital stocks for the above categories employs the following assumptions:

- New work expenditures are treated as capital outlays for structures;
- Asset life for each category is 50 years;
- Nominal expenditure flows are deflated by the ENR Construction Index, 1987=100; and
- Mississippi River and Tributaries expenditures are allocated to navigation and flood control using the Corps' 25 percent/ 75 percent distribution, respectively.



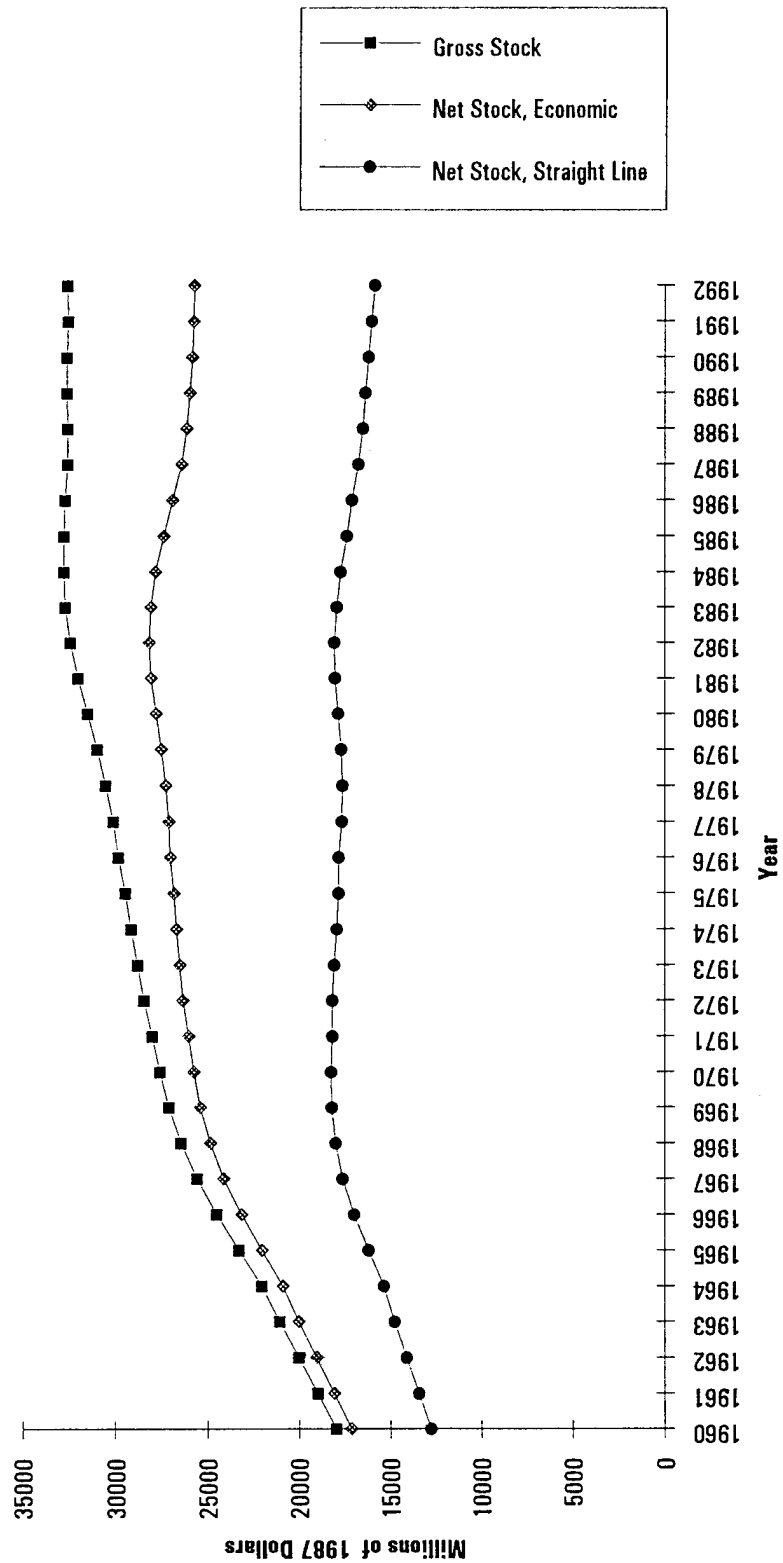
Figures 2-9 through 2-13 present the national gross and net stocks for each of the five expenditure categories from 1960 through 1992.<sup>18</sup> Differences between economic and straight-line decay are evident in these figures. Net capital stock in navigation (Figure 2-9) and multipurpose (Figure 2-11) have peaks in the early 1980s using economic decay, while the straight-line peaks in the late 1960s, more than 10 years earlier. All of the categories are in decline from the early 1980s through to 1992.

The following table compares average annual growth rates in the national total net stock for each category from 1985 through 1992:

<u>Category</u>	<u>Decay Pattern</u>	
	<u>Straight-Line</u>	<u>Economic</u>
Navigation	-1.300	-0.886
Flood Control	-1.500	-0.695
Multipurpose	-4.557	-2.392
MR-T	-1.275	-1.410

The growth rates for navigation and flood control components of MR-T are equal because they are based upon the same total expenditure series.

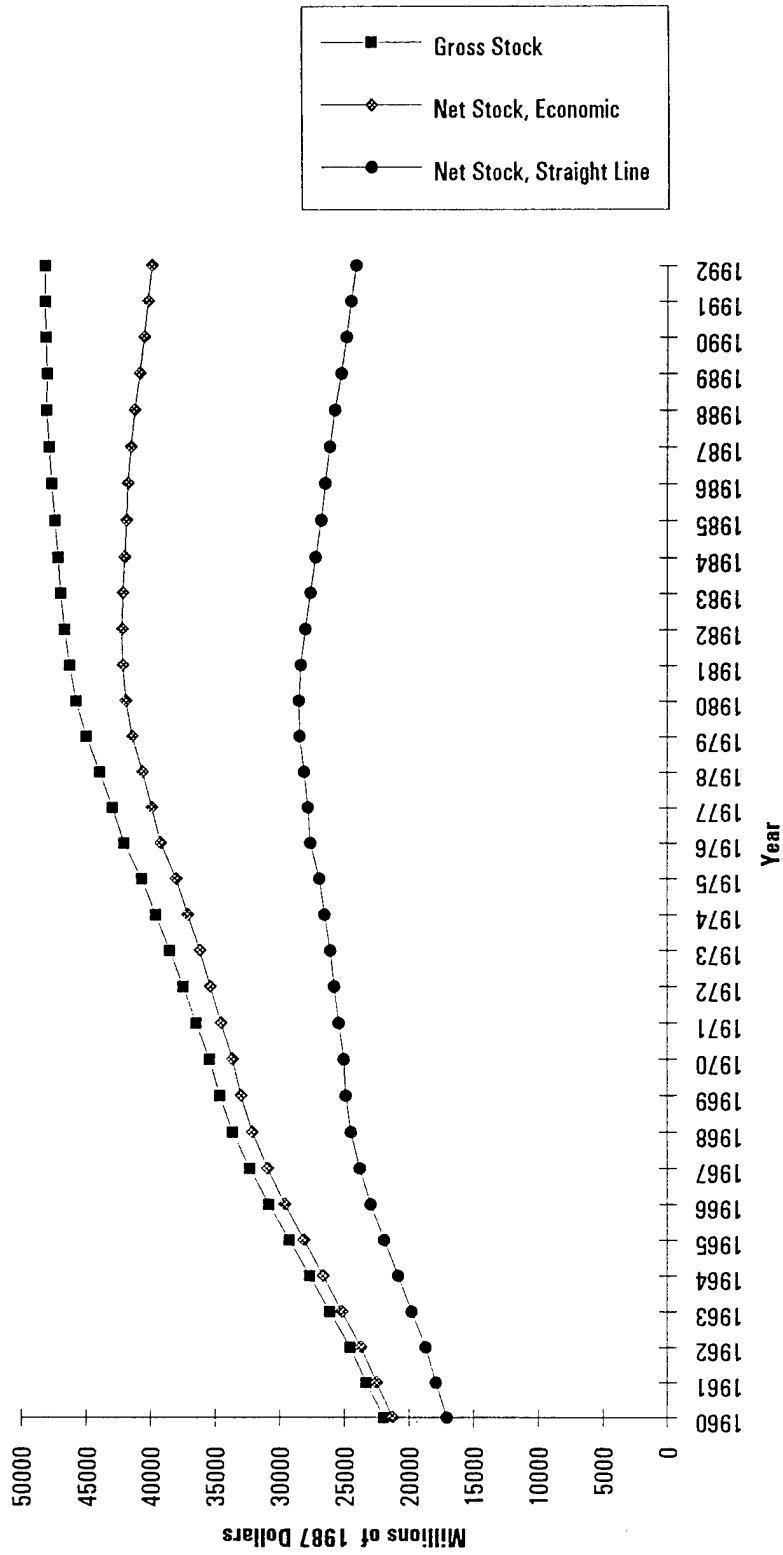
Tables 2-9 through 2-13 compare the 1985 and 1990 capital stocks for each category, based upon straight-line decay. The states are ranked according to the 1985 capital stock level, presented in thousands of 1987 dollars. The average annual growth rate from 1985 to 1990 is also presented. Of the top 10 ranked states in 1985 in navigation, only Louisiana had a positive increase in net capital. The results for flood control show very minor growth for three states ranked in the top 10, while none of the top 10 ranked states increased their net capital in the multipurpose category. Appendix II-4 provides information about the files containing these data.



Source: Apogee Research, from U.S. Army Corps of Engineers data

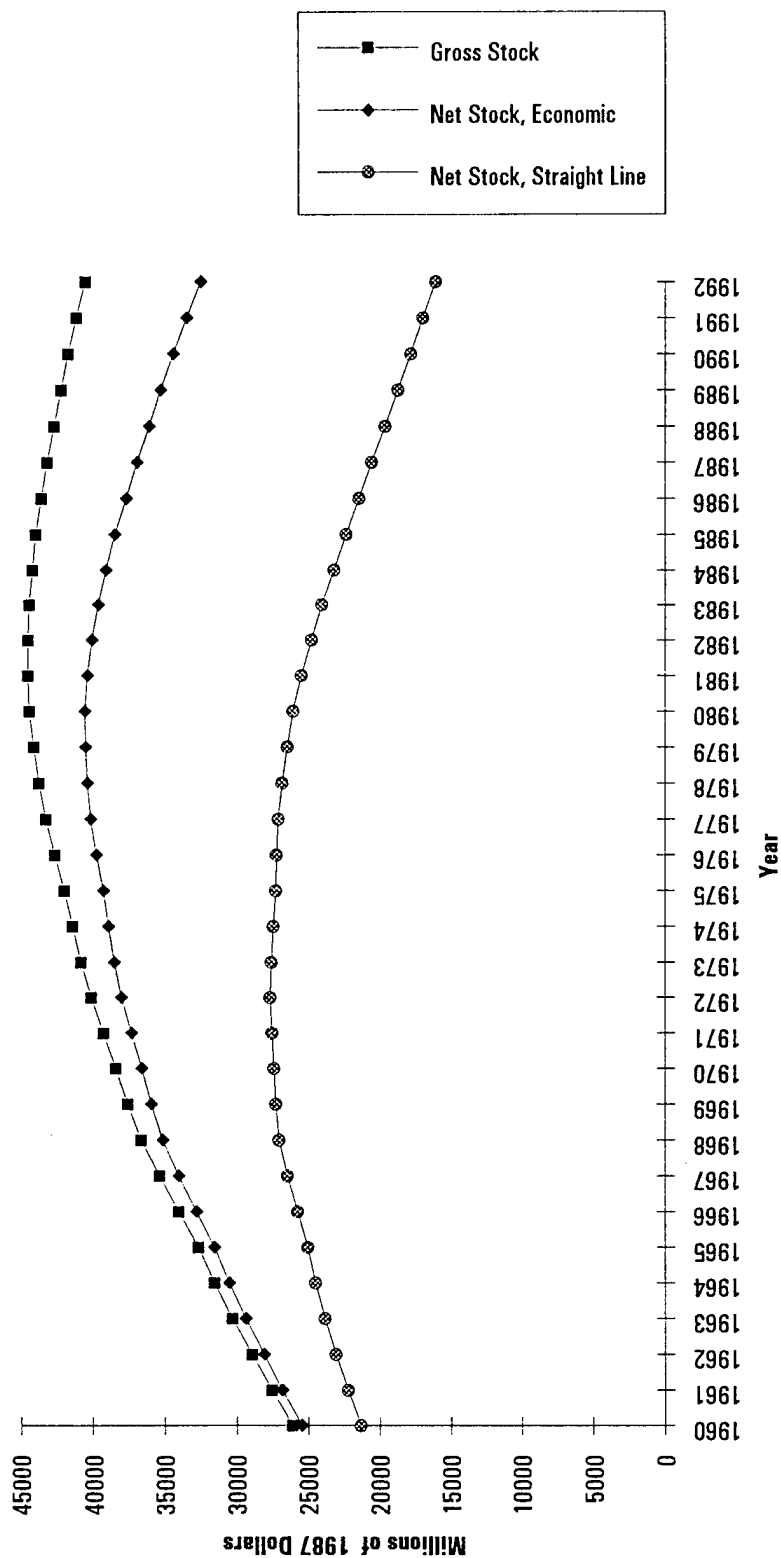
Figure 2:9: Navigation Capital Stock





Source: Apogee Research, from U.S. Army Corps of Engineers data

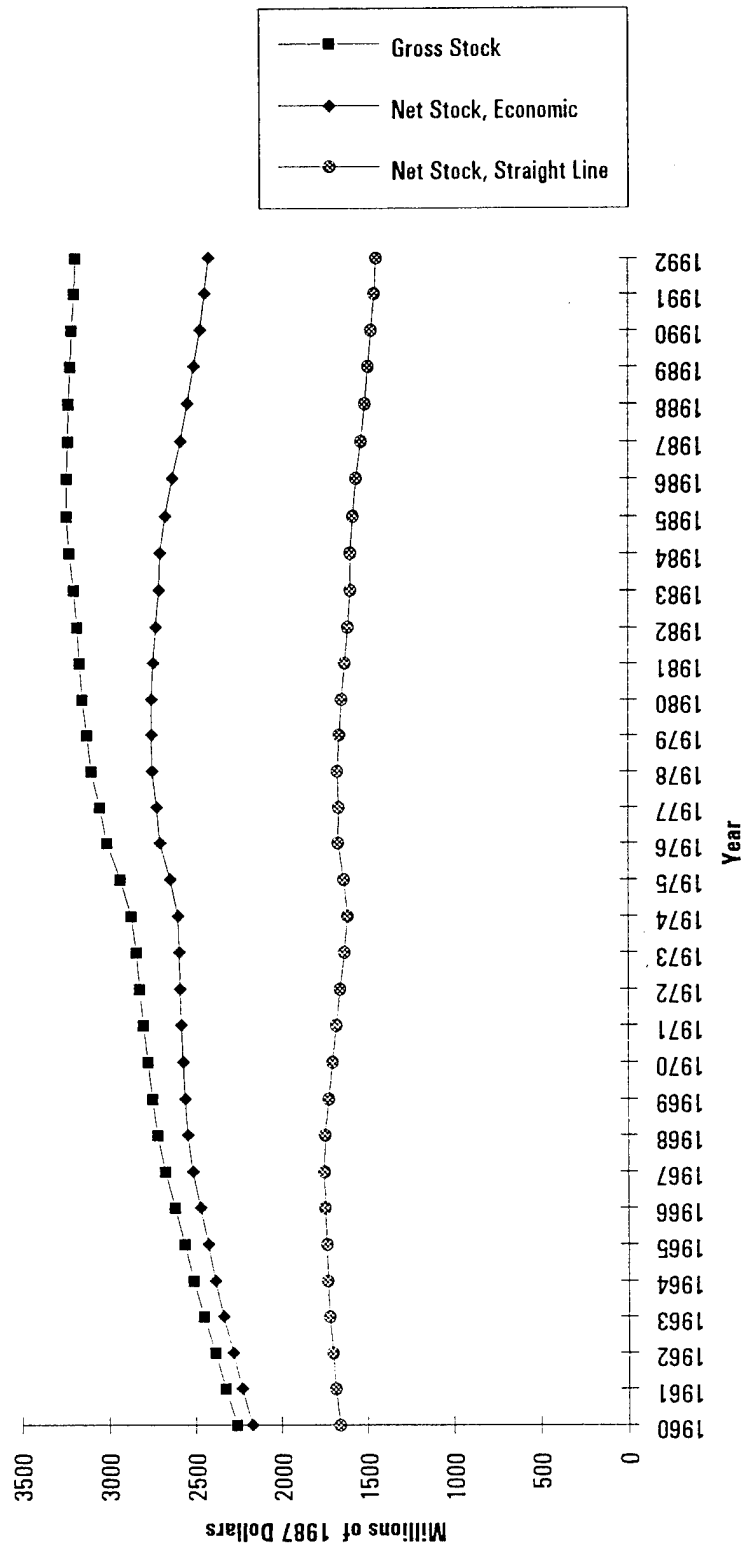
Figure 2:10: Flood Control Capital Stock



Source: Apogee Research, from U.S. Army Corps of Engineers data

Figure 2:11: Multipurpose Capital Stock

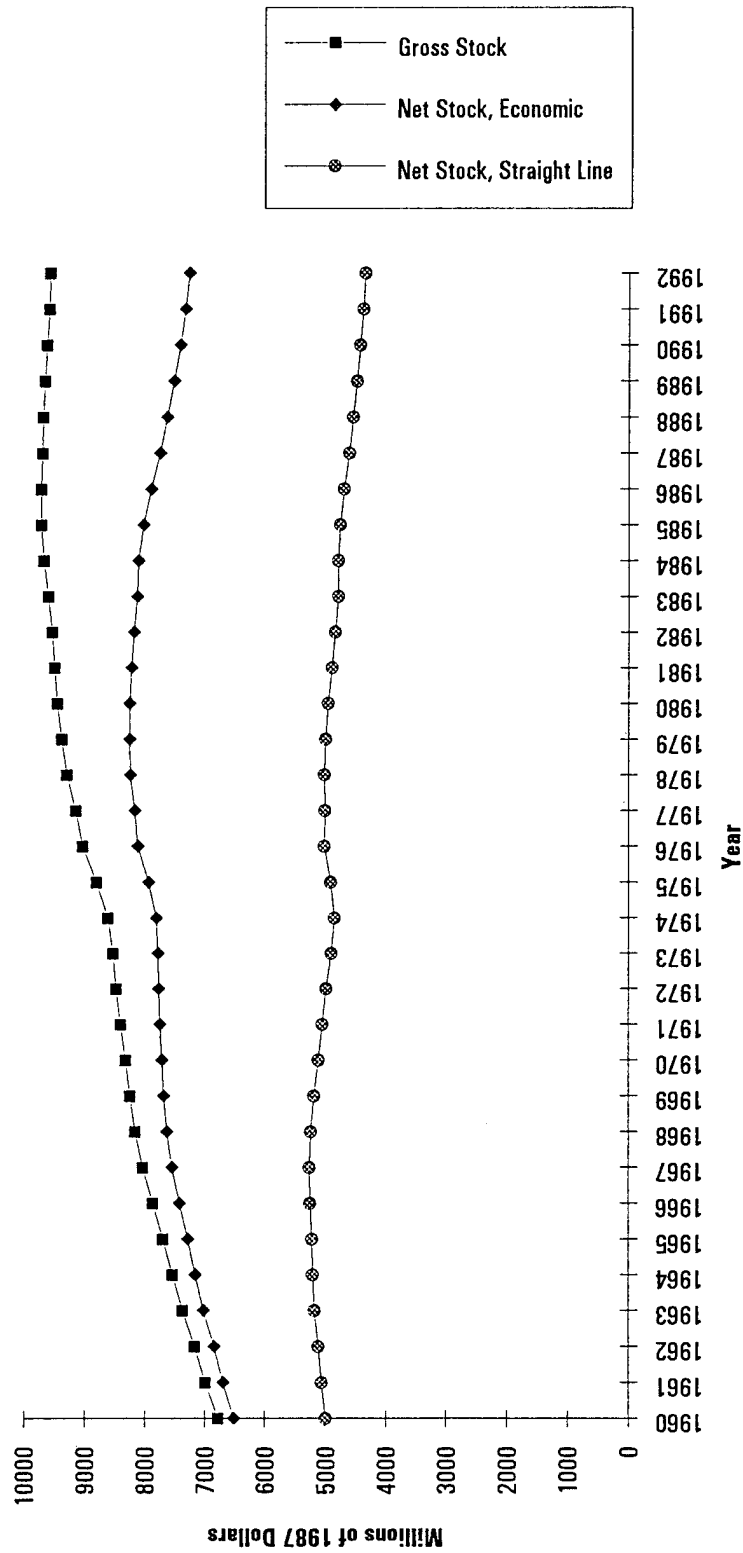




Source: Apogee Research, from U.S. Army Corps of Engineers data

Figure 2:12: Mississippi River & Tributaries,  
Navigation Capital Stock





Source: Apogee Research, from U.S. Army Corps of Engineers data

Figure 2:13: Mississippi River & Tributaries,  
Flood Control Capital Stock



TABLE 2-9

**NAVIGATION NET CAPITAL STOCK  
RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	Mississippi	1659786	1530400	-1.61
2	Arkansas	1596975	1391422	-2.72
3	Illinois	1368063	1285297	-1.24
4	Louisiana	1297790	1691104	5.44
5	Alabama	980896	940547	-0.84
6	Ohio	903182	732409	-4.11
7	Texas	835754	725980	-2.78
8	Florida	827467	727270	-2.55
9	Kentucky	768803	632848	-3.82
10	Indiana	601798	505608	-3.42
11	West Virginia	600637	673690	2.32
12	California	527294	471974	-2.19
13	New York	492923	408458	-3.69
14	Missouri	489777	385111	-4.69
15	Michigan	441505	355227	-4.26
16	Pennsylvania	385693	384524	-0.06
17	Oklahoma	343691	289179	-3.39
18	Oregon	308960	339328	1.89
19	South Carolina	294349	311433	1.13
20	New Jersey	280491	303872	1.61
21	Iowa	250138	157865	-8.79
22	Maryland	223629	282774	4.80
23	Minnesota	192985	141562	-6.01
24	Massachusetts	184485	144146	-4.82
25	Virginia	176616	158259	-2.17
26	Washington	168831	224139	5.83
27	Delaware	168511	136924	-4.07
28	Hawaii	165199	147021	-2.30
29	Nebraska	147073	105483	-6.43
30	Alaska	124680	130371	0.90
31	Wisconsin	111400	77801	-6.93
32	Georgia	104683	93925	-2.15
33	North Carolina	104240	98691	-1.09
34	Kansas	74980	47559	-8.70
35	Rhode Island	57789	46975	-4.06
36	Maine	47051	43380	-1.61
37	New Hampshire	33555	38348	2.71

TABLE 2-9 (cont.)

Rank	State	1985	1990	Annual Growth (%)
38	Connecticut	29928	21136	-6.72
39	District of Columbia	9126	5395	-9.98
40	Tennessee	8460	16354	14.09
41	Vermont	4406	3895	-2.43
42	Montana	1369	759	-11.11
43	Idaho	669	507	-5.40
44	North Dakota	565	452	-4.35
45	Colorado	294	224	-5.24
46	South Dakota	273	241	-2.46
47	Arizona	197	149	-5.38
48	Nevada	197	149	-5.38
49	New Mexico	158	104	-8.00
50	Wyoming	156	137	-2.50
51	Utah	52	38	-5.92
		=====	=====	=====
	Total	17397529	16210444	-1.30

Source: Apogee Research from U.S. Army Corps of Engineers data.

Note: Values are in thousands of 1987 dollars; straight-line decay.



TABLE 2-10

**FLOOD CONTROL NET CAPITAL STOCK  
RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	California	3412872	2994561	-2.58
2	Texas	2309628	2124797	-1.65
3	Pennsylvania	1826477	1508220	-3.76
4	Kansas	1577094	1268622	-4.26
5	Kentucky	1316421	1296375	-0.31
6	Oklahoma	1197374	973832	-4.05
7	West Virginia	1143745	1190148	0.80
8	Illinois	1108794	1236416	2.20
9	Missouri	1053214	1106908	1.00
10	Ohio	1017526	895626	-2.52
11	Iowa	901869	785952	-2.71
12	Florida	803295	790939	-0.31
13	Louisiana	588202	677956	2.88
14	Oregon	558913	547477	-0.41
15	Indiana	526924	442514	-3.43
16	Connecticut	479185	388211	-4.12
17	New York	477251	398259	-3.55
18	New Mexico	470691	394656	-3.46
19	Colorado	457775	384397	-3.43
20	Washington	454892	500263	1.92
21	North Carolina	433984	447262	0.60
22	Arkansas	398980	327135	-3.89
23	Massachusetts	391519	307712	-4.70
24	Maryland	391442	337791	-2.91
25	Virginia	382387	364297	-0.96
26	Mississippi	375411	352306	-1.26
27	Alaska	306738	295639	-0.73
28	Minnesota	260719	304262	3.14
29	Arizona	249452	340460	6.42
30	Nebraska	246517	218639	-2.37
31	Michigan	194711	175707	-2.03
32	Idaho	181428	150315	-3.69
33	North Dakota	175731	189431	1.51
34	New Jersey	152779	174212	2.66
35	Vermont	123901	95131	-5.15
36	Tennessee	114563	117242	0.46
37	New Hampshire	111875	81023	-6.25

TABLE 2-10 (cont.)

Rank	State	1985	1990	Annual Growth (%)
38	Hawaii	98833	107987	1.79
39	South Dakota	85074	69716	-3.90
40	Wisconsin	81414	79740	-0.41
41	Rhode Island	77668	63836	-3.85
42	Alabama	49086	91166	13.18
43	Georgia	46586	51664	2.09
44	Montana	45736	39086	-3.09
45	Utah	30994	45078	7.78
46	South Carolina	24664	29619	3.73
47	Wyoming	24480	20911	-3.10
48	Maine	19730	21091	1.34
49	Nevada	19213	20489	1.29
50	District of Columbia	13791	13130	-0.98
51	Delaware	10953	13053	3.57
		=====	=====	=====
	Total	26802501	24851259	-1.50

Source: Apogee Research from U.S. Army Corps of Engineers data.

Note: Values are in thousands of 1987 dollars; straight-line decay.



**TABLE 2-11**  
**MULTIPURPOSE NET CAPITAL STOCK**  
**RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	Washington	4789667	3937485	-3.84
2	Oregon	2931642	2302460	-4.72
3	Missouri	1584551	1381538	-2.70
4	Oklahoma	1287700	999416	-4.94
5	South Dakota	1281253	933567	-6.14
6	Arkansas	1275163	969223	-5.34
7	Georgia	1215676	1000804	-3.82
8	Montana	1213027	985343	-4.07
9	North Dakota	1177951	827368	-6.82
10	Idaho	859351	749744	-2.69
11	Tennessee	852563	637665	-5.64
12	California	711196	603397	-3.23
13	Kentucky	639723	478035	-5.66
14	Alabama	545166	457979	-3.43
15	South Carolina	472050	421440	-2.24
16	Texas	335784	241200	-6.40
17	Michigan	297169	214355	-6.32
18	Nebraska	186737	123831	-7.89
19	Alaska	180999	196445	1.65
20	Virginia	143909	95621	-7.85
21	North Carolina	118279	73997	-8.95
22	Florida	62549	41964	-7.67
23	New York	62430	51123	-3.92
24	New Jersey	43547	37521	-2.93
25	Pennsylvania	42647	36817	-2.90
26	Maine	20427	17858	-2.65
27	Maryland	8193	6323	-5.05
28	District of Columbia	8013	6249	-4.85
29	Mississippi	6740	5659	-3.44
30	Massachusetts	3401	3066	-2.05
31	Hawaii	3220	10842	27.48
32	Connecticut	1193	1109	-1.45
33	Kansas	919	760	-3.74
34	New Hampshire	611	666	1.75
35	Illinois	402	485	3.81
36	Rhode Island	394	362	-1.71
37	Ohio	324	381	3.30

TABLE 2-11 (cont.)

Rank	State	1985	1990	Annual Growth (%)
38	West Virginia	247	113	-14.55
39	Delaware	246	197	-4.31
40	Wisconsin	211	313	8.23
41	Minnesota	199	303	8.75
42	Colorado	192	134	-6.91
43	New Mexico	153	100	-8.18
44	Louisiana	150	98	-8.19
45	Indiana	98	213	16.89
46	Vermont	88	113	5.07
47	Iowa	76	67	-2.55
48	Utah	16	12	-5.18
49	Nevada	10	8	-5.18
50	Wyoming	4	3	-3.98
51	Arizona	0	0	.
		=====	=====	=====
	Total	22366256	17853772	-4.56

Source: Apogee Research from U.S. Army Corps of Engineers data.

Note: Values are in thousands of 1987 dollars; straight-line decay.



**TABLE 2-12**

**MISSISSIPPI RIVER & TRIBUTARIES  
NAVIGATION NET CAPITAL STOCK  
RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	Louisiana	721108	718814	-0.06
2	Mississippi	332896	295904	-2.33
3	Arkansas	315321	281278	-2.26
4	Tennessee	102549	88150	-2.98
5	Missouri	68961	58195	-3.34
6	Kentucky	22167	18842	-3.20
7	Iowa	10116	6823	-7.58
8	Illinois	9492	7931	-3.53
9	Kansas	2	0	-100.00
10	Indiana	1	0	-100.00
11	Ohio	1	0	-10.90
12	Montana	0	0	-100.00
13	Nebraska	0	0	-100.00
		=====	=====	=====
	Total	1582614	1475937	-1.28

Source: Apogee Research from U.S. Army Corps of Engineers data.

Note: Values are in thousands of 1987 dollars; straight-line decay.



TABLE 2-13

**MISSISSIPPI RIVER & TRIBUTARIES  
FLOOD CONTROL NET CAPITAL STOCK  
RANKED BY 1985 VALUE**

Rank	State	1985	1990	Annual Growth (%)
1	Louisiana	2163323	2156443	-0.06
2	Mississippi	998689	887713	-2.33
3	Arkansas	945964	843834	-2.26
4	Tennessee	307646	264450	-2.98
5	Missouri	206883	174584	-3.34
6	Kentucky	66502	56527	-3.20
7	Iowa	30349	20468	-7.58
8	Illinois	28476	23793	-3.53
9	Kansas	5	0	-100.00
10	Indiana	2	0	-100.00
11	Ohio	2	1	-10.90
12	Montana	1	0	-100.00
13	Nebraska	0	0	-100.00
		=====	=====	=====
	Total	4747842	4427813	-1.28

Source: Apogee Research from U.S. Army Corps of Engineers data.

Note: Values are in thousands of 1987 dollars; straight-line decay.



The following chart summarizes public capital stocks constructed for this project, by infrastructure category. Each series is available based upon both straight-line and economic decay patterns; the source of expenditure flow data, unless otherwise noted, is Census Government Finances:

<b>Public Capital Stock</b>	<b>Source of Government Investment</b>	<b>Level of Aggregation</b>	<b>Years Available</b>
Highways	State/Local State/Local Fed/St/Local (FHWA) Fed/St/Local (FHWA)	National State National State	1932-1990 1977-1990 1921-1992 1957-1990
Air Transportation	Federal/St/Local State/Local State/Local	National National State	1932-1990 1932-1990 1977-1990
Mass Transit	State/Local State/Local	National State	1932-1990 1977-1990
Water Resources:			
Water Transport and Terminals	State/Local State/Local	National State	1932-1990 1977-1990
Navigation	Federal (Corps)	State	1936-1992
Flood Control	Federal (Corps)	State	1936-1992
Mississippi River and Tributaries	Federal (Corps)	State	1936-1992
Multipurpose	Federal (Corps)	State	1936-1992
Wastewater Treatment (Sewerage)	State/Local State/Local	National State	1932-1990 1977-1990
Water Supply	State/Local State/Local	National State	1932-1990 1977-1990
Solid Waste Management	State/Local State/Local	National State	1932-1990 1977-1990

## CHAPTER II ENDNOTES

1. Drs. Michael Bell and Therese McGuire have prepared capital stock estimates for the Transportation Research Board, NCHRP, Project 2-17(3), for similar infrastructure categories as this project, using Census Government Finances and FHWA expenditure data.
2. While the level of detail available represents a significant improvement over previous infrastructure capital stocks, these improvements are not without limitations. For instance, capital stocks for all categories cover a common time period from 1977 to 1990. While this period is certainly relevant for current policy analysis, major changes have occurred both during and prior to this time. For example, this period follows completion of the Interstate Highway System, and includes a slowdown in highway investment. Therefore, as in any empirical study, care must be taken in both how the data are incorporated into the analysis, and the interpretation of those results.
3. Douglas Holtz-Eakin, "State-specific estimates of state and local government capital," *Regional Science and Urban Economics*, 23(1993), pp. 185-209, North Holland.
4. Capital stock for hazardous waste is not calculated due to data limitations.
5. The cumulative percent of the original expenditure that is discarded is obtained from *Fixed Reproducible Tangible Wealth in the United States, 1925-1989*, U.S. Department of Commerce, Bureau of Economic Analysis, January 1993, Table C, page M-18. The specific retirement pattern used is the modified Winfrey retirement pattern for fixed nonresidential private and government owned capital.
6. Jack E. Triplett, "Measuring the Capital Stock: A Review of Concepts and Data Needs," Workshop on the Measurement of Depreciation and Capital Stock, Conference on Research in Income and Wealth, National Bureau of Economic Research, Inc., June 5, 1992, p. 8.
7. Jack G. Faucett, "Estimation of Capital Stock in the United States: Comment," in Dan Usher (ed.), *The Measurement of Capital*, Conference on Research in Income and Wealth: Studies in Income and Wealth, vol. 45, Chicago, IL, University of Chicago Press for National Bureau of Economic Research, 1980, page 76.
8. Because the PPI, Capital Equipment index is available only from 1947 through the present, the annual percentage change in the PPI, Industrial Commodities, index is used to approximate the index from 1913 through 1946.
9. U.S. Department of Commerce. Bureau of Economic Analysis. *Fixed Reproducible Tangible Wealth in the United States, 1925-1989*. Washington, DC: U.S. Government Printing Office, January 1993. Page M-17, Table B.

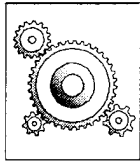


10. Their estimates are based upon the work of Randall Eberts, Chul Soo Park, and Douglas Dalenberg, *Public Infrastructure Data Development*, National Science Foundation, May 6, 1986. Apogee is looking into additional sources for indications of changes in these percentages over time, which may allow further refinement of highway capital stock.
11. U.S. Department of Commerce, Bureau of Economic Analysis, *Fixed Reproducible Wealth in the United States*, 1925-89, Table A-19, page 341.
12. As discussed in the Introduction, the water resources component of Census' natural resources expenditures is not included.
13. Douglas Holtz-Eakin, "State-specific estimates of state and local government capital," *Regional Science and Urban Economics*, 23(1993), pp. 185-209, North Holland.
14. We examined other time periods, including 1977 alone, and the 1977-1990 average. The relative distribution of state shares remained similar, however, actual percentage shares fluctuate. The 1977-1980 average was determined to be a reasonable approximation of the relative state shares to allocate 1976 capital stock.
15. This corresponds to equation (2) in Holtz-Eakin's paper. However, that equation is incorrectly reported, in that the benchmark capital stock ( $K_{1976}$  in our case) does not deteriorate - i.e., it is missing the cumulative effect  $(1-\delta)^{14}$ . Thus, if used as stated, all deterioration is imposed on subsequent investment flows. Professor Holtz-Eakin acknowledged this error in the paper, and indicated it is not carried over to the estimation of his capital stock.
16. The original data file contains multiple records per state per year. After discussions with the Corps and a comparison of expenditure totals, by category, to a Corps provided hard-copy report, it was determined to retain all records. Multiple records are summed to one record per state per year. Expenditures for the 50 states and the District of Columbia are retained, even though minor expenditures are reported for other geographic areas.
17. In addition, to construct such a series, an assumption regarding the distribution of total navigation expenditures, for example, between channels and harbors and inland waterways must be made for the entire period 1936 through 1992. Data on which to base this assumption are available from 1979 through 1990, and indicate that the expenditure distribution between channels and harbors, and inland waterways has remained relatively steady with channels and harbors averaging 29 percent of total navigation expenditures. This is not true for flood control expenditures: local protection has risen from 30 percent of total flood control expenditures to 70 percent over the 1979 to 1990 period. Moreover, data at the state level for each subdivision will be sensitive to changes in the location of Corps projects. Therefore, an

assumption of the distribution of expenditures at the national level may be inappropriate to apply to individual states.

18. The national totals are the unweighted sum of 50 states and the District of Columbia.





## **AN INTERIM REPORT - VOLUME 3 DATA ON FEDERAL CAPITAL STOCKS AND INVESTMENT FLOWS**

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### **CHAPTER III: PRIVATE SECTOR DATA**

To assess the relationship between public infrastructure and private economic activity, information on private employment, output, prices, wages, and capital are required. Relevant information has been collected at both national and state levels, by industry when available. As the analysis is intended to be performed at the state level, state specific price index information is desirable, however, these data are not generally available. Subsequent analyses, therefore, may be required to assume a single price across states.

#### **NATIONAL DATA**

The national level data collected consists primarily of general economic indicator information, including prices and economic activity. Professor Nadiri is assisting in providing information necessary to calculate the user cost of private capital, on a state basis.<sup>1</sup>

#### **Prices**

Several price indices were needed to deflate nominal expenditures to constant dollar values. This is required in the construction of capital stock, and for deflating expenditure and income data for the empirical analyses. The following price indices are available:

- Engineering News-Record (ENR) Construction Price Index, 1906 to 1992;
- ENR Building Price Index, 1913 to 1992;
- Federal Highway Administration Construction Indexes, from 1922 through 1992;
- Producer Price Index (PPI), Capital Equipment, 1947 through 1992;
- PPI, Industrial Commodities, 1913 through 1992;
- Consumer Price Index, All Urban Consumers, U.S. city average, 1913 through 1992;
- Unit Labor Cost Index, Business Sector, all persons, 1947 through 1992.



The ENR construction and building indices are obtained from the "First Quarterly Cost Report," *Engineering News-Record*, March 29, 1993, pp. 34-39. The construction and building indices are available from 1906 through 1992, and 1913 through 1992, respectively. The primary difference between the two indices is that the construction index uses common labor rates while the building index uses skilled labor rates. Both indices are published with 1913 as the base year (1913=100). Apogee indexed both series to 1987 for purposes of constructing public capital stocks. Both the 1913 and 1987-based series are available.

The Federal Highway Administration maintains construction price indexes for excavation, surfacing, and structures, and a composite index of the three. The continuous series for each index is obtained by combining two separate series published in *Highway Statistics*.<sup>2</sup>

PPI indices are obtained from the Bureau of Labor Statistics, Producer Price Indexes, Information Branch, U.S. Department of Labor. PPI, capital equipment, is used to deflate non-construction capital outlays in the construction of public capital stocks. To obtain a longer time-series, the growth rate in PPI, industrial commodities index (base year 1987), is applied to the PPI, capital equipment index (base year 1987), for the years 1913 to 1946. The BLS suggested that the industrial commodities index reasonably tracks the trend of the capital equipment index.

The consumer price index is available from the Bureau of Labor Statistics, U.S. Department of Labor. The unit labor cost index is available from the Bureau of Labor Statistics, Office of Productivity and Technology, U.S. Department of Labor. The series provided is for the business sector only, which represents approximately 80 percent of all labor. Appendix III-1 describes the file containing the price index information.

Unit labor cost is the ratio of total compensation, in current dollars, to current output (value added). Compensation includes all outlays necessary to secure labor, including wages and salaries, health-care, unemployment insurance, and social security. While bonuses are included, other subsidies, such as free parking or subsidized lunches are not included. Business sector employment excludes general government, non-profit, and private household employees.

## **Private Capital Stock**

Private capital stock are constructed from 1947 through 1991 at the 2-digit SIC level by Drs. Michael Bell and Therese McGuire for NCHRP Project 2-17(3). These data have been requested through NCHRP, although Dr. Bell has indicated that the method used to construct their series may make it inappropriate for use in production function analyses.

## STATE DATA

### Economic and Demographic Data

The Bureau of Economic Analysis, U.S. Department of Commerce, provided a variety of information at the state level. Population, personal income, earnings, and employment are available at both the state and county level (if necessary). Output, earnings, and employment are available at the industry level. The data described below are at the state level.

Gross State Product. Gross state product (GSP) represents "the market value of goods and services produced by labor and property located in a State. It is the State counterpart of the Nation's gross domestic product (GDP) from the national income and product accounts (NIPA's)." <sup>3</sup> The data are obtained from the Bureau of Economic Analysis, U.S. Department of Commerce, Regional Economic Analysis Division.

GSP includes the following components:<sup>4</sup>

- Compensation of employees;
- Proprietor's income with inventory valuation adjustment and capital consumption allowances;
- Indirect business tax and nontax liability; and
- Other charges, mainly capital-related.

GSP is available for 61 industry classifications, by state, in both nominal dollars and real 1982 dollars, from 1977 through 1989. The real values are based upon national price deflators which are described in the January 1991 *Survey of Current Business*.<sup>5</sup> Appendix III-2 provides additional details regarding the data available.

Personal Income. These data are supplied by the Bureau of Economic Analysis, U.S. Department of Commerce, Regional Economic Information System. Personal Income for the years 1969-1990 is obtained from the County Annual Series Table CA05.

Total personal income is available at the state level, while total earnings are available by state and 2-digit SIC level. Earnings are composed of wages and salaries, other labor income, and proprietors income, with wages and salaries making up approximately 80 percent of the total. Industrial earnings are classified by place-of-work. To compute personal income (classified by place of residence), total earnings by place-of-work is adjusted to a net earnings by place of residence by subtracting personal contributions for social insurance and adding an adjustment for residence, i.e., an adjustment for earnings of commuters who cross the area boundary. Dividends, interest, rent, and transfer payments are added to the earnings to yield the personal income of the residents of a given area. Details of these data are provided in Appendix III-3.





Population. Population, by state, in thousands of persons, is included in the personal income file described above from 1969 to 1990, as described in Appendix III-3. These data are also available at the county level, if needed.

Employment. These data are provided by the Bureau of Economic Analysis, Regional Economic Information System, U.S. Department of Commerce. Employment is obtained from the County Annual Series Table CA25 and covers the years 1969-1990.

Employment consists of annual data on the number of full and part-time employees by major industry. Employment is comprised of the total number of wage and salary employees by 1-digit SIC code, and the number of farm and non-farm proprietors. These data comprise a count of jobs, not the number of employed persons. Individuals holding multiple jobs, including part-time jobs, are counted once for each job. The file containing this information is described in Appendix III-4. Employment data by state and 2-digit SIC are available from BEA if this level of detail is required.

### **Private Capital Stock**

Michael Bell and Therese McGuire have prepared two private capital stock series, by state, at the 2-digit SIC level, for the years 1970 through 1990 at the 1-digit SIC level. These data have been requested through NCHRP. Other sources include total private capital, by state, constructed by Alicia Munnell, from 1960 to 1988; and manufacturing sector private capital, estimated by Catherine Morrison.

Private capital stock information is necessary not only as a direct input to the empirical analyses, but also to obtain the deflator and deterioration information used in the construction of the series. This information, in addition to interest rate and corporate tax information is required for estimating the user cost of capital in the cost function analysis. Availability of this information at the state and industry level is being investigated.



### CHAPTER III ENDNOTES

1. Other private sector data include the Capital, Labor, Energy, and Materials Services (KLEMS) data from 1947-1988, for manufacturing industry only (SIC 20 through 39), from the Bureau of Economic Analysis, U.S. Department of Commerce.
2. The Federal Highway Administration published two construction price index series: one from 1922 through 1975, base year 1967; and another from 1956 through 1992, base year 1987. The two series incorporate different commodity bundles. To construct a continuous series, the annual percentage change in the 1922-1975 series is applied to the level of the 1956-1992 series. Indexes for the years 1926-1929, 1931-34, 1936-39, 1941-44, 1946-49 are interpolated.

FHA provided Apogee with the composite index from 1956 to 1992, base year 1987. Data in *Highway Statistics: Summary to 1975* and *Highway Statistics: Summary to 1985* are used to complete each series.

3. Edward A. Trott, Jr., Ann E. Dunbar, and Howard L. Friedenberg, "Gross State Product by Industry, 1977-89," *Survey of Current Business*, 71(December 1991):43-59.
4. Ibid., page 43
5. Frank De Leeuw, Michael Mohr, and Robert P. Parker, "Gross Product by Industry, 1977-88: A Progress Report on Improving the Estimates," *Survey of Current Business* 71(January 1991): 23-37.



## APPENDIX I

### 1. CENSUS, GOVERNMENT FINANCES

All data are in thousands of fiscal year, nominal dollars.

#### National Level Historical Series

Data were provided to Apogee on diskette from U.S. Department of Commerce, Bureau of the Census, through the U.S. Advisory Commission on Intergovernmental Relations (ACIR). Three files contain the historical data:

HIS00.DIF: Federal, State, and Local Governments  
HIS01.DIF: State and Local Governments  
HIS04.DIF: Federal Government

Each file contains national expenditure data from the Government Finances Historical Series, for the following fiscal years:

1902, 1913, 1922, 1927;  
1932 through 1952, every second year;  
1953 through 1990, continuously.

Cells containing "N/A" indicate data was either not available or not collected at that time. A zero value indicates no expenditures were made in that year.

The prefix of the variable name identifies level of government:

- Variables in HIS00.DIF begin with "Z" to indicate "All Governments" expenditures, historical series;
- Variables in HIS01.DIF begin with "ZS" to indicate "State and Local" governments combined, historical series; and
- Variables in HIS04.DIF begin with "ZF" to indicate "Federal" government, historical series.

The following table presents the variable names and their description. The prefix will change for each file as described above. The variables are listed in their order of appearance in the file. The years for which data are available differs by level of government and expenditure type, as indicated in the third column (for convenience, the available years are presented as if they are continuous).



Government Finances	Variable List for the files: HIS00.DIF; HIS01.DIF; HIS04.DIF	
Variable Name	Variable Description	Fiscal Years Available
ZHYTOT	Highways, Total Expenditure	FY1902-FY1990
ZHYIGE	Highways, Intergovernmental Expenditure	FY1902-FY1990
ZHYDIR	Highways, Direct Expenditure	FY1902-FY1990
ZHYOPS	Highways, Current Operations	FY1952-FY1990
ZHYCAP	Highways, Capital Outlay	FY1952-FY1990
ZHYCON	Highways, Construction	FY1952-FY1990
ZATTOT	Air Transportation, Total Expenditure	FY1902-FY1990; ALL FY1952-FY1990; S&L FY1954-FY1990; FED
ZATIGE	Air Transportation, Intergovernmental Expenditure	FY1902-FY1990; ALL FY1902-FY1990; S&L FY1954-FY1990; FED
ZATDIR	Air Transportation, Direct Expenditure	FY1902-FY1990; ALL FY1952-FY1990; S&L FY1902-FY1990; FED
ZATOPS	Air Transportation, Current Operations	FY1952-FY1990
ZATCAP	Air Transportation, Capital Outlay	FY1952-FY1990
ZATCON	Air Transportation, Construction	FY1952-FY1990
ZWTTOT	Water Transport and Terminals, Total Expenditure	FY1902-FY1990; ALL FY1952-FY1990; S&L FY1967-FY1990; FED
ZWTIGE	Water Transport and Terminals, Intergovernmental Expenditure	FY1902-FY1990; ALL FY1902-FY1990; S&L FY1967-FY1990; FED
ZWTDIR	Water Transport and Terminals, Direct Expenditure	FY1902-FY1990; ALL FY1952-FY1990; S&L FY1902-FY1990; FED

ZWTOPS	Water Transport and Terminals, Current Operations	FY1953-FY1990; ALL FY1953-FY1990; S&L FY1952-FY1990; FED
ZWTCAP	Water Transport and Terminals, Capital Outlay	FY1952-FY1990
ZWTCON	Water Transport and Terminals, Construction	FY1952-FY1990
ZTRTOT	Transit Subsidies, Total Expenditure	FY1902-FY1990
ZTRIGE	Transit Subsidies, Intergovernmental Expenditure	FY1902-FY1990
ZTRSUB	Transit Subsidies, Direct Subsidies	FY1902-FY1990
ZNRTOT	Natural Resources, Total Expenditure	FY1902-FY1990; ALL FY1902-FY1990; S&L FY1952-FY1990; FED
ZNRIGE	Natural Resources, Intergovernmental Expenditure	FY1902-FY1990; ALL FY1902-FY1990; S&L FY1952-FY1990; FED
ZNRDIR	Natural Resources, Direct Expenditure	FY1902-FY1990
ZNROPS	Natural Resources, Current Operations	FY1955-FY1990; ALL FY1955-FY1990; S&L FY1952-FY1990; FED
ZNRCAP	Natural Resources, Capital Outlay	FY1952-FY1990
ZNRCON	Natural Resources, Construction	FY1952-FY1990
ZSTOT	Sewerage, Total Expenditure	FY1956-FY1990
ZSIGE	Sewerage, Intergovernmental Expenditure	FY1902-FY1990
ZSDIR	Sewerage, Direct Expenditure	FY1956-FY1990
ZSOPS	Sewerage, Current Operations	FY1956-FY1990
ZSCAP	Sewerage, Capital Outlay	FY1952-FY1990
ZSCON	Sewerage, Construction	FY1952-FY1990
ZWMTOT	Solid Waste Management, Total Expenditure	FY1956-FY1990
ZWMIGE	Solid Waste Management, Intergovernmental Expenditure	FY1902-FY1990



ZWMDIR	Solid Waste Management, Direct Expenditure	FY1956-FY1990
ZWMOPS	Solid Waste Management, Current Operations	FY1957-FY1990
ZWMCAP	Solid Waste Management, Capital Outlay	FY1957-FY1990
ZWMCON	Solid Waste Management, Construction	FY1967-FY1990
ZTUTOT	Transit Utility, Total Expenditure	FY1902-FY1990
ZTUOPS	Transit Utility, Current Operations	FY1952-FY1990
ZTUCAP	Transit Utility, Capital Outlay	FY1952-FY1990
ZTUCON	Transit Utility, Construction	FY1952-FY1990
ZTUIOD	Transit Utility, Interest on Debt	FY1952-FY1990
ZWUTOT	Water Supply Utility, Total Expenditure	FY1902-FY1990
ZWUOPS	Water Supply Utility, Current Operations	FY1952-FY1990
ZWUCAP	Water Supply Utility, Capital Outlay	FY1952-FY1990
ZWUCON	Water Supply Utility, Construction	FY1952-FY1990
ZWUIOD	Water Supply Utility, Interest on Debt	FY1952-FY1990
YEAR	Fiscal Year of Data Series	FY1902-FY1990

### State Level Expenditure Series

Data for fiscal years 1977 through 1990 were provided by the Governments Division, Bureau of the Census, U.S. Department of Commerce. All data are in thousands of nominal dollars, and may include unpublished revisions.

Intergovernmental expenditures (IGE) and expenditures for current operations are calculated by Apogee using the identities:

Total Expenditures - Direct Expenditures = IGE; and  
 Direct Expenditures - Capital Outlays - Interest on Debt (if applicable) = Current Operations.

Current Operations includes both operating and maintenance expenditures. Census does not separate the two types of expenditure.

Interest on the Debt is provided separately only for Mass Transit and Water Supply expenditures; debt interest is not identifiable as a separate expenditure item for the other infrastructure modes.

Prior to fiscal year 1989-90, the Solid Waste Management series was titled "Sanitation Other Than Sewerage". The title was changed to more accurately reflect the expenditure data in the series with no change made to the data series.

Three files contain the state level expenditures:

GOVALL.DIF: State and local government expenditures, combined;  
 GOVST.DIF: State government expenditures only; and  
 GOVLOC.DIF: Local government expenditures only.

Each file contains expenditures for all 50 states, the District of Columbia, and the total U.S., for fiscal years 1977 through 1990. The following list identifies the variables contained in each of the above files. The variables YEAR, STNUM, and STCD are the same in each file. The remaining variables appear as below in GOVALL.DIF; in GOVST.DIF, they have a prefix "S"; and in GOVLOC.DIF, they have a prefix "L" (e.g., TUTOT, STUTOT, and LTUTOT respectively).

		Government Finances Files: GOVALL.DIF; GOVST.DIF; GOVLOC.DIF.
Column Number	Variable Name	Variable Description
1	YEAR	Fiscal Year
2	STNUM	State Number, Census Assigned
3	STCD	State Postal Code
4	TUTOT	Transit Utility, Total Expenditure
5	TUDIR	Transit Utility, Direct Expenditure
6	TUCAP	Transit Utility, Capital Outlay
7	TUCON	Transit Utility, Construction
8	TUIOD	Transit Utility, Interest on Debt
39	TUOPS	Transit Utility, Current Operations
40	TUIGE	Transit Utility, Intergovernmental Expenditure



9	WUTOT	Water Utility, Total Expenditure
10	WUDIR	Water Utility, Direct Expenditure
11	WUCAP	Water Utility, Capital Outlay
12	WUCON	Water Utility, Construction
13	WUIOD	Water Utility, Interest on Debt
41	WUOPS	Water Utility, Current Operations
42	WUIGE	Water Utility, Intergovernmental Expenditure
14	TRSUB	Transit Subsidies, Direct Expenditure
15	HYTOT	Highways, Total Expenditure
16	HYDIR	Highways, Direct Expenditure
17	HYCAP	Highways, Capital Outlay
18	HYCON	Highways, Construction
43	HYOPS	Highways, Current Operations
44	HYIGE	Highways, Intergovernmental Expenditure
19	ATTOT	Air Transportation, Total Expenditure
20	ATDIR	Air Transportation, Direct Expenditure
21	ATCAP	Air Transportation, Capital Outlay
22	ATCON	Air Transportation, Construction
45	ATOPS	Air Transportation, Current Operations
46	ATIGE	Air Transportation, Intergovernmental Expenditure
23	WTTOT	Water Transportation, Total Expenditure
24	WTDIR	Water Transportation, Direct Expenditure
25	WTCAP	Water Transportation, Capital Outlay
26	WTCON	Water Transportation, Construction
47	WTOPS	Water Transportation, Current Operations
48	WTIGE	Water Transportation, Intergovernmental Expenditure
27	NRTOT	Natural Resources, Total Expenditure



28	NRDIR	Natural Resources, Direct Expenditure
29	NRCAP	Natural Resources, Capital Outlay
30	NRCON	Natural Resources, Construction
49	NROPS	Natural Resources, Current Operations
50	NRIGE	Natural Resources, Intergovernmental Expenditure
31	STOT	Sewerage, Total Expenditure
32	SDIR	Sewerage, Direct Expenditure
33	SCAP	Sewerage, Capital Outlay
34	SCON	Sewerage, Construction
51	SOPS	Sewerage, Current Operations
52	SIGE	Sewerage, Intergovernmental Expenditure
35	WMTOT	Solid Waste Management, Total Expenditure
36	WMDIR	Solid Waste Management, Direct Expenditure
37	WMCAP	Solid Waste Management, Capital Outlay
38	WMCON	Solid Waste Management, Construction
53	WMOPS	Solid Waste Management, Current Operations
54	WMIGE	Solid Waste Management, Intergovernmental Expenditure

## 2. FEDERAL HIGHWAY ADMINISTRATION

### National level data

The following files contain national expenditures on highways, as provided by the Federal Highway Administration.



HF212.WK1: Table contains annual total disbursements for highways, by all types of government from 1921 to 1992, from Table HF-212, **Highway Statistics, Summary to 1985**. Data are in millions of dollars.

<u>Column</u>	<u>Heading</u>	<u>Description</u>
1	YEAR	Year
2	FEDCAP	Federal Govt. Capital Outlays
3	FEDMAIN	Federal Govt. Maintenance Expenditures
4	FEDCUR	Federal Govt. Total Current Disbursements
5	FEDTOT	Federal Govt. Total Disbursements
6	STCAP	State Agencies and D.C. Capital Outlays
7	STMAIN	State Agencies and D.C. Maintenance Expenditures
8	STCUR	State Agencies and D.C. Total Current Disbursements
9	STTOT	State Agencies and D.C. Total Disbursements
10	CNTCAP	Counties and Townships Capital Outlays
11	CNTMAIN	Counties and Townships Maintenance Expenditures
12	CNTCUR	Counties and Townships Total Current Disbursements
13	CNTTOT	Counties and Townships Total Disbursements
14	MUNCAP	Municipalities Capital Outlays
15	MUNMAIN	Municipalities Maintenance Expenditures
16	MUNCUR	Municipalities Total Current Disbursements
17	MUNTOT	Municipalities Total Disbursements
18	TOTCAP	Total Capital Outlays
19	TOTMAIN	Total Maintenance Expenditures
20	TOTCUR	Total Current Disbursements
21	TOTTOT	Total Disbursements

Total Current Disbursements = Capital Outlays + Maintenance (including traffic services) + Administration and Research + Highway Law Enforcement and Safety + Interest on Debt;

Total Disbursements - Total Current Disbursements = Debt Retirement (par value).

HF-221-1..6.WK1: Six tables contain annual capital expenditures for highways, by federal systems, from 1956 to 1991. The data contain the level of detail as Table HF-221, **Highway Statistics, Summary to 1985**. Layout of individual changes as detail included in Table HF-221 changes.

LF-202.WK1: Table contains annual disbursements by counties and townships for highways, 1921-90. Data are from Table LF-202, **Highway Statistics, Summary to 1985**.

- SF-202.WK1: Table contains annual disbursements from state highway user revenues and other receipts applicable to highways, 1921-91. Data are from Table SF-202, **Highway Statistics, Summary to 1985**.
- SF-204.WK1: Table contains annual disbursements for state administered highways, 1921-91. Data are from Table SF-204, **Highway Statistics, Summary to 1985**.
- SF-206.WK1: Table contains annual state expenditures and fund transfers for local roads and streets, 1921-91. Data are from Table SF-206, **Highway Statistics, Summary to 1985**.
- UF-202.WK1: Table contains annual disbursements for highways by municipalities, 1921-90. Data are from Table UF-202, **Highway Statistics, Summary to 1985**.

#### State level data

The following files contain expenditures on highways, by state, as provided by the Federal Highway Administration.

- HF-201.WK1: Table contains annual capital outlay expenditures for highways by all levels of government, by state, from 1957 to 1990. Data are from Table HF-201, **Highway Statistics, Summary to 1985** and Table HF-2 in the annual **Highway Statistics** reports from 1986 to 1991.
- HF-202.WK1: Table contains annual maintenance expenditures for highways by all levels of government, by state, from 1957 to 1990. Data are from Table HF-202, **Highway Statistics, Summary to 1985** and Table HF-2 in the annual **Highway Statistics** reports from 1986 to 1991.
- SE-201.WK1: Table contains annual expenditures for capital outlay on state-administered highways, by state, from 1921 to 1991. Data are from Table SE-201, **Highway Statistics, Summary to 1985** and Table SF-4 in the annual **Highway Statistics** reports from 1986 to 1991.
- SE-202.WK1: Table contains annual expenditures for maintenance on state-administered highways, by state, from 1921 to 1991. Data are from Table HF-202 in **Highway Statistics, Summary to 1985** and Table SF-4 in the annual **Highway Statistics** reports from 1986 to 1991.

Each of these four tables has the following format:



<u>Column Number</u>	<u>Contents</u>
1	Year
2-52	Data series by state; in order of Postal Code
53	US Totals.

The first row of each file contains the state names by postal code. All data are in thousands of dollars.

### 3. U.S. ARMY CORPS OF ENGINEERS

Expenditure data obtained from the U.S. Army Corps of Engineers are available in a single file: COREXP4.DIF. The data are in **thousands of nominal dollars**, by state, from fiscal years 1936 through 1990. The following information is included with the data:

<u>Column</u>	<u>Column Heading</u>	<u>Description</u>
1	NEWNAV	New Work, Navigation
2	OMNAV	O&M, Navigation
3	NEWFC	New Work, Flood Control
4	OMFC	O&M, Flood Control
5	NEWMP	New Work, Multipurpose
6	OMMP	O&M, Multipurpose
7	NEWMRT	New Work, Mississippi River and Tributaries
8	OMMRT	O&M, Mississippi River and Tributaries
9	YEAR	2-digit year
10	STNUM	Corps assigned state number
11	STNAME	State Name

The data are sorted by State Number and Year; O&M is operations and maintenance.

### 4. APPALACHIAN REGIONAL COMMISSION

The Appalachian Regional Commission (ARC) provided expenditure data (grants) for wastewater, water supply, and solid waste for fiscal years 1966 through 1992. Based upon conversations with ARC, the following allocation of project categories was made:

<u>ARC Project Description</u>	<u>Apogee Allocation</u>
Sewage System	Wastewater
Water System	Water Supply
Water & Sewer	50% Water Supply ; 50% Wastewater



From fiscal year 1966 to 1975 the federal fiscal year was July 1 to June 30. The federal fiscal year changed in 1976 to October 1 - September 30. As a result, there was a transition quarter from July to October 1976. Fiscal year 1977 represents the period October 1 to September 30. According to ARC, no funds were dispersed during the 1976 transition quarter.

The data, sorted by year and state, are available on the file ARC.DIF, with the following information:

<u>Column</u>	<u>Column Heading</u>	<u>Description</u>
1	STCD	State postal code
2	YEAR	2-digit year
3	ARCENV	Solid waste expenditures
4	ARCSEW	Sewerage expenditures
5	ARCWAT	Water supply expenditures
6	ARCTOT	Total of ARCENV, ARCSEW, ARCWAT

The individual expenditure categories may contain negative values. These are included in the summation, ARCTOT.

## 5. ECONOMIC DEVELOPMENT ADMINISTRATION

The Economic Development Administration (EDA) provided expenditure data (grants and direct assistance) for water supply and wastewater treatment projects they financed. The original data include 6,704 projects funded from fiscal year 1966 through April 5, 1993 including obligated and disbursed dollars. Individual project expenditures are available at the city, county, and state level, by 4-digit SIC code. Individual project expenditures were aggregated into water supply and wastewater treatment, by state. The following list indicates how SIC project codes are allocated to project category, based upon information provided by EDA:

<u>SIC Code</u>	<u>EDA Category</u>	<u>Apogee Category</u>
4941	Water System	Water Supply
4942	Water Treatment	Water Supply
4943	Water Line	Water Supply
4944	Water Transport	Water Supply
4948	Water Pump	Water Supply
4949	Water and Sewer	50% water supply; 50% wastewater
4952	Sewer System	Wastewater
4953	Sewage Treatment	Wastewater



	Lagoon	
	Waste Treatment	
4954	Sewer Line	Wastewater
4981	Reservoir (potable water)	Water Supply
	Water Supply - Reservoir	
	Dam/Reservoir Combined	
4984	Water Storage not elsewhere classified	Water Supply
	Water Tank	
4985	Water Well	Water Supply
4986	Water Purchase	Water Supply

Projects classified under six additional SIC codes were allocated into either of the three Apogee categories according to the specific project descriptions provided by EDA. Below is a listing of the SIC categories and how they were allocated.

<u>SIC Code</u>	<u>Apogee Allocation</u>
4950	Sewerage
4951	Water Supply
4955	Sewerage
4980	Water Resources
4983	Water Supply

The original data include SIC codes not related to water supply or wastewater treatment; these data are not included in the final data file. Expenditures in Puerto Rico are not included in the final dataset.

The data, sorted by YEAR and STCD are available in the file EDA.DIF, with the following information:

<u>Column</u>	<u>Column Heading</u>	<u>Description</u>
1	YEAR	2-digit year
2	STCD	State postal code
3	EDAWSD	Water supply, disbursed dollars
4	EDAWTD	Wastewater treatment, disbursed dollars
5	EDAWSO	Water supply, obligated dollars
6	EDAWTO	Wastewater treatment, obligated dollars



## 6. FEDERAL EXPENDITURES BY STATE

Copies of *Federal Expenditures by State* are available for each year it is published, fiscal years 1981 through 1992. Table 2 of this publication contains federal government grants to state and local governments, by federal agency, for each state. Grant amounts reflect total federal expenditure, inclusive of capital and operational outlays; federal loans are not reported in this publication. Apogee received from the Governments Division, Bureau of the Census, Table 2 for fiscal years 1988 through 1992 on diskette. The remaining years are from hard-copy documents.

Data for the years 1969 through 1981 are obtained from *Federal Aid to States*. This document, no longer in publication, was compiled by the U.S. Department of Treasury. The grant information in this publication is the predecessor to that presented in Federal Expenditures Table 2. The two series are consistent in their coverage. Copies of *Federal Aid to States* from 1969 to 1981 are located at GAO. The first year of publication has not been determined.

In 1976, the Federal government changed its fiscal year from July to October. As a result, *Federal Aid to States* contains data for the "transition quarter". At the same time, the published data changed units from dollars to thousands of dollars. The transition quarter data are retained in the files as reported; the units of measurement are adjusted to be consistent throughout. Changes to the data as reported in these publications are noted below, by program.

### Rural Water and Waste Disposal Grants, U.S. Department of Agriculture

*Federal Expenditures by State* reports "Rural and Wastewater Disposal Grants" for the years 1969 through 1992. According to RDA, the best approximation of this data into water supply and wastewater treatment is 60 percent/40 percent, respectively. This allocation is used to provide individual approximations for these categories.

Data reported in the 1970 through 1979 *Federal Aid to States* are adjusted according to additional information provided in footnotes to the series prior to making the above allocation.

### Department of Housing and Urban Development

The Department of Housing and Urban Development awards capital grants to finance water resource, solid waste, water supply, and wastewater treatment facilities. Expenditures from fiscal years 1969 to 1981 are from *Federal Aid to States*. Between fiscal years 1969 and 1981, this data is categorized as "Water and Sewer Facilities," and as "Basic Water and Sewer Facilities" from 1976 to 1981. Under each category, 50 percent of total expenditures are allocated to Water Supply and 50 percent to Wastewater Treatment.



Expenditure data for fiscal years 1982 to 1992 are from unpublished data at HUD and the Urban Institute, which divides the data into its two sub-components: the Community Development Block Grant Entitlement Program; and the Community Development Block Grant State and Small Cities Program.

Expenditures under the Community Development Block Grant State and Small Cities Program for the fiscal years 1982-1992 are from unpublished HUD data that divide expenditures into one of four categories: (1) Water/Sewer/Flood/Drainage; (2) Water; (3) Sewer; (4) Flood and Drainage Facilities. These categories correspond to this study's infrastructure categories as follows:

<u>HUD Category</u>	<u>Infrastructure Category</u>
Water/Sewer/Flood/Drainage	1/3 allocated to Water Supply 1/3 allocated to Wastewater 1/3 allocated to Water Resources
Water	Water Supply
Sewer	Wastewater
Flood and Drainage Facilities	Water Resources

Under the State and Small Cities Program, expenditure data is not available for the states of Hawaii and New York. According to HUD, these expenditures are not included in their in-house database and as such, are unavailable at this time.

Expenditures from the Community Development Block Grant Entitlement Program for fiscal years 1988-1990 are from unpublished data provided by the Urban Institute. Below is a listing of how the HUD data codes are allocated to the infrastructure categories.

<u>HUD Code and Description</u>	<u>Infrastructure Category</u>
O3H - Solid waste disposal facilities.	Solid Waste
O3I - Flood and drainage facilities. This does not include storm sewers or street drains. It only includes capital grants for flood control or irrigation (i.e. retention ponds or catch basins).	Water Resources
O3J - Water improvements.	Water Supply
O3O - Sewer improvements. Includes all storm sewer projects undertaken without any indication of street improvements.	Wastewater

Data are not available for these programs for fiscal years 1982-1987 and 1991-1992. The data include negative expenditures, reflecting either a community's decision to reallocate unspent funds or HUD's disqualification of already expended funds.



## EPA Construction Grants for Wastewater Treatment

Expenditure data for wastewater treatment construction grants administered by the Department of Interior between the fiscal years 1957 - 1970, and by the Environmental Protection Agency for the years 1971 - 1992 are available. The fiscal year data from 1957 to 1968 was obtained from a document titled, "Review of Municipal Waste Water Treatment Works Program - USEPA" issued November 1974 by an EPA Construction Grant review group. The nominal expenditure information, available only at the national level, is presented in the following list:

<u>Fiscal Year</u>	<u>Federal Expenditure (\$millions)</u>
1957	1
1958	17
1959	36
1960	40
1961	44
1962	42
1963	52
1964	66
1965	70
1966	81
1967	84
1968	122
Total	655

Wastewater treatment construction grant expenditures, from fiscal year 1969 to 1992, are disaggregated by state and obtained from two sources: *Federal Aid to States* for fiscal years 1969 - 1981; and *Federal Expenditures by State* for fiscal years 1982 - 1992. The exact column description in both sources changed over time. However, it is assumed that the content did not change from year to year, and all expenditures represent wastewater treatment expenditures for the entire time period. The list below indicates the different titles for the two sources, *Federal Aid to States*, for fiscal years 1969 - 1981, and *Federal Expenditures by State*, for fiscal years 1982 - 1991:

<u>Fiscal Year</u>	<u>Column Heading</u>
1969 - 1970	Department of Interior; Federal Water Pollution Control Federation "Waste Treatment Works Construction";
1971 - 1972	EPA, "Construction Grants";
1973 - 1977	EPA, "Construction of Waste Treatment Facilities";



1978 - 1979	EPA, "Construction of Wastewater Treatment Facilities"; and
1980 - 1991	EPA, "Construction of Wastewater Treatment Works".

The grant data, in thousands of dollars, are contained in a single file, FEDEXP.DIF, with the following format:

<u>Column</u>	<u>Heading</u>	<u>Description</u>
1	YEAR	Year, 2-digit (transition quarter is coded as year 76.5)
2	STNUM	State number, alphabetical order of states
3	STNAME	State name
4	FEATF	Airport and Airway Trust Fund, FAA
5	FEFCA	Flood Control Act 1954, U.S. Army Corps of Engineers
6	FEHUDW	Water Supply, U.S. Department of Housing and Urban Development (HUD).
7	FEHUDS	Wastewater Treatment, HUD
8	FEHTF	Highway Trust Fund, Federal Highway Administration
9	FEWWT	Wastewater Treatment Works, EPA
10	FEFWH	Water Supply, Farmers Home Administration
11	FEFHS	Wastewater treatment, Farmers Home Administration
12	FEUMT	Urban Mass Transit, U.S. Department of Transportation

## 7. STATE REVOLVING LOAN FUND PROGRAM, EPA

Since fiscal year 1988, the U.S. Environmental Protection Agency has provided capitalization grants to individual state revolving loan funds to finance wastewater treatment facilities (Title II Capitalization Grant Program). These grants are used to capitalize the loan funds and to directly finance capital projects. Information is not available to determine the proportion of these grants that are loaned to capital projects in any given year, no adjustments are made to the data. The data was obtained directly from the EPA headquarters.

The District of Columbia does not have a state revolving loan fund program; it receives monies for wastewater treatment facilities through the construction grants program.

These data are available for the fiscal years 1988 through 1992, by state, on file EPASRF.DIF, with the following layout:

Column	Heading	Description
1	STCD	State code, 2-character postal code
2-6	Y1988-Y1992	SRF grants, fiscal years 1988-1992

The data are sorted by state code, and are in thousands of dollars.

## APPENDIX II

### 1. CENSUS HISTORICAL EXPENDITURES

As discussed in the text, expenditure data from 1932 through 1951 are estimated in order to provide a sufficient time series to construct capital stocks. This section provides additional details regarding variations in the general procedure for specific modes.

#### Air Transportation

National state and local government direct, capital outlay, and construction expenditures are available from 1952 through 1990. The file provided to Apogee indicates that direct expenditures prior to these years, if any, are included in the category "Other and Unallocable." As state and local government involvement in air transportation was virtually non-existent until after World War II, it is assumed that these expenditures are zero prior to 1947, with capital outlay and construction expenditures increasing geometrically from 1947 through 1952. As a result, the state and local government air transportation capital stock does not begin until 1947.

Federal total direct expenditures are available, every other year, from 1932 to 1952. Values for the odd years are interpolated base upon the geometric growth rate across the available data. Capital outlays are assumed to be a fixed 6.25 percent of total direct expenditures, based upon the 1952 proportion, from 1932 to 1951. Construction expenditures are assumed to be a fixed 47.0 percent of capital outlays over this same period, based upon 1952's distribution. Capital stock for all government expenditures is based upon the sum of federal, state, and local construction and non-construction capital outlays.

#### Water Transport and Terminals

National state and local government direct, capital outlay, and construction expenditures are available from 1952 through 1990. Prior to this time, any direct expenditures for this function are included in "Other and Unallocable". To approximate this series from 1932 to 1951, the growth rate in the state and local investment series "Conservation and Development", published by BEA, was applied to the 1952 Government Finances direct expenditure level. The BEA series is based upon the Bureau of the Census' Value of New Construction Put in Place data series. This latter series only reports state and local government data back to 1947, with total public construction (federal, state, and local) available to 1915. As the BEA state and local series is available prior to 1947 these data are used in the calculation.

The BEA data are reported in 1987 dollars. To apply the growth rate in this data to the Government Finances data, the 1952 value was put in terms of 1987 dollars, using the ENR Construction Index. This value became the benchmark for the 1932 to 1951 series.



## **Sewerage**

National state and local government direct, capital outlay, and construction expenditures are available from the Government Finances Historical Series machine readable file on a continuous basis from 1956 through 1990. Capital outlays and construction expenditures are available from 1952 through 1990.

Prior to 1952, state and local government sewerage and solid waste management direct expenditures are combined. Combined totals are available for the years 1902, 1913, 1922, 1927, 1932, 1936, 1940, 1942, 1944, 1946, 1948, 1950, 1952, and 1955. These values are obtained from hard-copy *Historical Statistics on Governmental Finances and Employment, 1977 Census of Governments*, U.S. Department of Commerce, Bureau of the Census. The intervening years were imputed using the implied year to year growth rates of the available data. Sewerage is assumed to be a constant 62 percent of the combined total, with the remaining 38 percent allocated to solid waste management.

Sewerage capital outlays are assumed to be a constant 70 percent of direct expenditures from 1932 through 1951; construction expenditures are a constant 85 percent of capital outlays over the same period. These allocations are based upon the 1956 relationship among the expenditure categories.

## **Solid Waste Management**

Government Finances has a continuous series of direct state and local solid waste management expenditures from 1956 through 1990. Capital outlays are available for 1957, 1967, and 1972 through 1990. Construction expenditures are available for 1967, and 1972 through 1990.

Using the imputed direct expenditure series described above under sewerage, direct solid waste management expenditures are imputed from 1932 through 1955. Capital outlays are assumed to be eight (8.0) percent of direct expenditures and construction expenditures are assumed to be 46 percent of capital outlays, based upon 1967 data, for the 1932 through 1955 period. From 1958 through 1966, and 1968 through 1971, capital outlays are assumed to be eight (8.0) percent of the known direct expenditures for those years.

## **2. NATIONAL CAPITAL STOCK DATA**

### **Census Government Finances**

National capital stocks are available from 1932 to 1990. The results based upon the straight-line decay pattern are contained in files with the (A) suffix; economic decay results are

in files with the (B) suffix. Note that air transportation has two sets, one based upon state and local government expenditures, and one based on all government expenditures.

The following list identifies the file name for each mode:

<u>Category</u>	<u>Filename</u>
Highways	HYCAP(A,B).DIF
Air Transportation:	
State/Local Government	AIRCAP(A,B).DIF
All Governments	AIRFED(A,B).DIF
Mass Transit	TRNCAP(A,B).DIF
Water Transport and Terminals	WTRCAP(A,B).DIF
Water Supply	WATCAP(A,B).DIF
Wastewater Treatment (Sewerage)	SEWCAP(A,B).DIF
Solid Waste Management	SWMCAP(A,B).DIF

The variables included in HYCAP(A,B).DIF begin with the prefix HY, with the suffix identifying the particular series, as follows:

__GP:	Gross Stock, Paving
__NP:	Net Stock, Paving
__DP:	Cumulative Retirements, Paving
__RP:	Annual Decay, Paving
__GG:	Gross Stock, Grading
__NG:	Net Stock, Grading
__DG:	Cumulative Retirements, Grading
__RG:	Annual Decay, Grading
__GS:	Gross Stock, Structures
__NS:	Net Stock, Structures
__DS:	Retirements, Structures
__RS:	Annual Decay, Structures
__GT:	Gross Stock, Total
__NT:	Net Stock, Total
__DT:	Retirements, Total
__RT:	Annual Decay, Total



For the remaining files, the variables contained in each have a prefix the same as the filename (e.g. Air transportation variable names begin with AIR), with suffix codes as follows:

__GE:	Gross Stock, Equipment
__NE:	Net Stock, Equipment
__DE:	Cumulative Retirements, Equipment
__RE:	Annual Decay, Equipment
__GS:	Gross Stock, Structures
__NS:	Net Stock, Structures
__DS:	Cumulative Retirements, Structures
__RS:	Annual Decay, Structures
__GT:	Gross Stock, Total
__NT:	Net Stock, Total
__DT:	Retirements, Total
__RT:	Annual Decay, Total

The first column in all files is a 2-digit year indicator. Data for all national capital stock files are in thousands of 1987 dollars.

### **Federal Highway Administration**

National level highway capital stock, based upon capital expenditures by all levels of government, are available from 1921 to 1992, in the following two files:

- FHCAPA.DIF      Straight-line decay; and
- FHCAPB.DIF      Economic decay.

The variable names and positions are the same as those described above for the HYCAP(A,B).DIF files. The capital stock values are in millions of 1987 dollars, sorted by year.

## **3. STATE CAPITAL STOCK DATA**

### **Census, Government Finances Based Capital Stock**

State specific capital stocks are available from 1977 through 1990 and are contained on two files:

- STSTOCKA.DIF      Straight-line Decay; and
- STSTOCKB.DIF      Economic Decay.

The variable names are the same for each file:

<u>Column</u>	<u>Name</u>	<u>Description</u>
1	YEAR	Year, 2-digit
2	STNUM	State Number, Census assigned
3	STCD	State Postal Code
11	STNAME	State Name
4	HYSTK	Net Highway Capital Stock
5	ATSTK	Net Air Transportation Capital Stock
6	TUSTK	Net Mass Transit Capital Stock
7	WUSTK	Net Water Supply Capital Stock
8	WTSTK	Net Water Transport and Terminals Capital Stock
9	WMSTK	Net Solid Waste Management Capital Stock
10	SWSTK	Net Sewerage Capital Stock

The data are rounded to the nearest thousand dollars, and are in constant 1987 dollars. The files are sorted by state number and year.

### **Federal Highway Administration**

State specific net capital stock for highways, based upon capital expenditures by all levels of government are available in the following files:

- FHSTAT.A.DIF, straight-line decay; and
- FHSTATB.DIF, economic decay.

The variables included in each file are the following:

<u>Column</u>	<u>Name</u>	<u>Description</u>
1	STNUM	State Number
2	STNAME	State Name
3	STCD	State Postal Code
4	YEAR	Year
5	HYSTK	Net Highway Capital Stock

The data are sorted by state number and year. Net capital stocks are in millions of 1987 dollars.

### **U.S. Army Corps of Engineers-based Capital Stock**

State specific capital stocks for each category are contained on two files:



- CORPCAP.DIF, straight-line decay; and
- CORPCAP2.DIF, economic decay.

Each file is sorted by state number and year, and the data are in **thousands of 1987 dollars**. The variable names in each file are the same, as described below:

<u>Column</u>	<u>Variable Name</u>	<u>Description</u>
1	STNUM	State Number
2	YEAR	Two-digit year
23	STNAME	State Name

In addition, variables for each expenditure category have a prefix identifying the category and a suffix identifying the component of capital stock, as follows:

<u>Columns</u>	<u>Variable Prefix</u>	<u>Description</u>
3 - 6	NAV__	Navigation
7 - 10	FLD__	Flood Control
11 - 14	MP__	Multipurpose
15 - 18	MRTN__	Mississippi River and Tributaries, Navigation
19 - 22	MRTF__	Mississippi River and Tributaries, Flood Control

The suffixes assigned to each of the above categories are the following:

<u>Variable Suffix</u>	<u>Description</u>
__DEP	Annual Decay
__DIS	Cumulative Retirements
__GRO	Gross Capital Stock
__NET	Net Capital Stock





## APPENDIX III

### 1. PRICES

Price indices are in the file PRICE.DIF, with the following variables:

<u>Column Heading</u>	<u>Description</u>
YEAR	Year, 2-digit indicator;
CONS13	ENR Construction Index, base year 1913, 1906-1992;
CONS87	ENR Construction Index, base year 1987, 1906-1992;
BLDG13	ENR Building Index, base year 1913, 1913-1992;
BLDG87	ENR Building Index, base year 1987, 1913-1992;
PPI82	Producer Price Index, Capital Equipment, 1947-1992, base year 1982;
PPI87	Producer Price Index, Capital Equipment, 1913-1992, base year 1987, combined Capital Equipment and Industrial Commodities indexes from 1913 to 1946, 1913-1992;
PPIC82	PPI, Industrial Commodities index, 1913-1992, base year 1982;
PPIC87	PPI, Industrial Commodities index, 1913-1992, base year 1987;
CPI82-84	Consumer Price Index, All Urban Consumers, base year 1982-84=100, 1913-1992;
ULC82	Unit labor cost, business sector, 1947-1992, base year 1982;
ULC87	Unit labor cost, business sector, 1947-1992, base year 1987;
FHCON87	Federal Highway Administration, composite construction index, base year 1987, constructed from 1922-1975 and 1956-1992 series, 1922-1992;
FHEXC87	Federal Highway Administration, excavation index, base year 1987, constructed from 1922-1975 and 1956-1992 series, 1922-1992;
FHSUR87	Federal Highway Administration, surfacing index, base year 1987, constructed from 1922-1975 and 1956-1992 series, 1922-1992; and
FHSTR87	Federal Highway Administration, structures index, base year 1987, constructed from 1922-1975 and 1956-1992 series, 1922-1992.

The variables are listed in the column order of appearance; the data are sorted by year.

### 2. GROSS STATE PRODUCT

These data are obtained from the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Analysis Division and are available in current and 1982 dollars for the years 1977-1989. The estimates are consistent with the gross product by industry presented in the Survey of Current Business [January 1991 and April 1991].



Data Documentation: Gross State Product (GSP) data are available for the years 1977 through 1989. Selected regions, states, and/or industries are included. The data are presented in the following files, as received from the BEA:

<u>Filename</u>	<u>Region covered</u>
US.PRN	United States
NE.PRN	New England + States
ME.PRN	Mideast + States
GL.PRN	Great Lakes + States
PL.PRN	Plains + States
SE.PRN	Southeast + States
SW.PRN	Southwest + States
RM.PRN	Rocky Mountain + States
FW.PRN	Far West + States
AH.PRN	Alaska + Hawaii

<u>Record position</u>	<u>Field size</u>	<u>Content</u>
1	1	Region code
2	1	blank
3-4	2	State code
5	1	blank
6-11	6	Industry code
12	1	blank
13-16	4	Line code
17-24	8	1977 GSP
25-32	8	1978 GSP
33-40	8	1979 GSP
41-48	8	1980 GSP
49-56	8	1981 GSP
57-64	8	1982 GSP
65-72	8	1983 GSP
73-80	8	1984 GSP
81-88	8	1985 GSP
89-96	8	1986 GSP
97-104	8	1987 GSP
105-112	8	1988 GSP
113-120	8	1989 GSP

Region code: 1 digit code identifying the BEA region.

State code: 2-digit FIPS code identifying the State.

Industry code: 4-6-digit code identifying the industry. The first two digits are the division code, the next digit appears only in manufacturing and designates durable (1) and nondurable (2), the fourth and fifth digits are the 2-digit SIC codes, and the last digit designates a 3-digit SIC code when needed.

Line code: 1-4 digit code identifying the component of GSP shown. All components are presented in millions. The two components are coded as follows:

0 Constant (1982) \$ GSP; and  
100 Current \$ GSP.

Data fields: Gross State Product estimates by state, by industry, for a given year.

Note: State and Region Codes are listed in Appendix III, Table 1;  
Industry Codes are listed in Appendix III, Table 2.

### 3. PERSONAL INCOME / POPULATION

These data are supplied by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Regional Economic Information System. Personal income data for the years 1969 through 1990 are obtained from the County Annual Series, Table CA05.

BEA Definition. Earnings are composed of wages and salaries, other labor income, and proprietors income. The industrial earnings data are classified by place-of-work. In order to compute personal income (classified by place of residence), total earnings by place-of-work is adjusted to a net earnings by place of residence by subtracting personal contributions for social insurance and adding an adjustment for residence, i.e., an adjustment for earnings of commuters who cross the area boundary. Dividends, interest, rent, and transfer payments are added to the earnings to yield the personal income of the residents of a given area.

Income data, in thousands of dollars, and population data, in thousands of persons, are contained on file CA05PT.PRN. Data at the 2-digit SIC level represent earnings, the largest single component of which is wages and salaries. The record of the file is as follows:

<u>Column Number</u>	<u>Field Name</u>	<u>Content</u>
1	STCD	FIPS State Code
2	TABLCD	Table code
3	LINECD	Line Code
4	REGION	BEA Region Code



5	FIRST	First Year of Data
6-27	1969-1990	Data Fields (1969-1990)
28	DISCL	Disclosure Codes

FIPS Code: 2 digit FIPS code identifying the State.

Table Code: Code identifying data series;

A (all) = area title record (state name);

B = Total Personal Income & Earnings.

Line Code: 3 digit code identifying each component (line) on the table.

First Year: First year of data on record = 1969.

Disclosure Codes: each digit of the code corresponds to a data field on the record. Thus, the third number of the code refers to the data in column 8 for the year 1971. The disclosure codes are as follows:

- 0 = Data shown.
- 1 = Data not shown to avoid disclosure of confidential information (D).
- 2 = Data less than \$50,000.
- 3 = Impaired value printed with an "E" next to the data-- the data in this cell constitutes the major portion of the true estimate. Data for "lower level" estimates that are not shown in order to avoid disclosure of confidential information were excluded from this total.
- 9 = Not available.

Note: State and Region Codes are listed in Appendix III, Table 1;  
Line Codes are listed in Appendix III, Table 3.

#### 4. EMPLOYMENT

These data are available from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Regional Economic Information System. Employment is obtained from the County Annual Series Table CA25 and covers the years 1969-1990. Employment at the 2-digit SIC level, by state, can be obtained from the BEA if needed.

BEA Definition. The employment series contains annual data on the number of full and part time employees by major industry. Employment is comprised of the total number of wage and salary employees by 1-digit SIC Industry, and the number of farm and non-farm proprietors. These data comprise a count of jobs, not the number of employed persons. Individuals holding

multiple jobs, including part-time jobs, are counted once for each job. The data are available on file CA25PT.PRN with the following record format:

<u>Column Number</u>	<u>Field Name</u>	<u>Content</u>
1	STCD	FIPS State Code
2	TABLCD	Table code
3	LINECD	Line Code
4	REGION	BEA Region Code
5	FIRST	First Year of Data
6-27	1969-1990	Data Fields (1969-1990)
28	DISCL	Disclosure Codes

FIPS Code: 2 digit FIPS code identifying the State.

Table Code: Code identifying data series;  
A (all) = area title record (state name);  
K = Full & Part Time Employment.

Line Code: 3 digit code identifying each component (line) on the table.

First Year: First year of data on record = 1969.

Disclosure Codes: Each digit of the code corresponds to a data field on the record. For example, the third number of the code refers to data in column 8 for the year 1971. The disclosure codes are as follows:

- 0 = Data shown;
- 1 = Data not shown to avoid disclosure of confidential information (D);
- 2 = Data less than \$50,000 (L);
- 3 = Impaired value printed with an "E" next to the data-- the data in this cell constitutes the major portion of the true estimate. Data for "lower level" estimates that are not shown in order to avoid disclosure of confidential information were excluded from this total; and
- 9 = Not available.

Note: State and Region Codes are listed in Appendix III, Table 1;  
Line Codes are Listed in Appendix III, Table 4.



# **APPENDIX III** **TABLE 1**

## **REGION CODES:**

<u>Region Code</u>	<u>Region</u>
1	New England
2	Mideast
3	Great Lakes
4	Plains
5	Southeast
6	Southwest
7	Rocky Mountain
8	Far West
9	Alaska & Hawaii

## **STATE CODES:**

<u>FIPS State Code</u>	<u>Postal Code</u>	<u>State</u>
0	US	UNITED STATES
1	AL	ALABAMA
2	AK	ALASKA
4	AZ	ARIZONA
5	AR	ARKANSAS
6	CA	CALIFORNIA
8	CO	COLORADO
9	CT	CONNECTICUT
10	DE	DELAWARE
11	DC	DISTRICT OF COLUMBIA
12	FL	FLORIDA
13	GA	GEORGIA
15	HI	HAWAII
16	ID	IDAHO
17	IL	ILLINOIS
18	IN	INDIANA
19	IA	IOWA
20	KS	KANSAS
21	KY	KENTUCKY
22	LA	LOUISIANA
23	ME	MAINE
24	MD	MARYLAND
25	MA	MASSACHUSETTS

26	MI	MICHIGAN
27	MN	MINNESOTA
28	MS	MISSISSIPPI
29	MO	MISSOURI
30	MT	MONTANA
31	NE	NEBRASKA
32	NV	NEVADA
33	NH	NEW HAMPSHIRE
34	NJ	NEW JERSEY
35	NM	NEW MEXICO
36	NY	NEW YORK
37	NC	NORTH CAROLINA
38	ND	NORTH DAKOTA
39	OH	OHIO
40	OK	OKLAHOMA
41	OR	OREGON
42	PA	PENNSYLVANIA
44	RI	RHODE ISLAND
45	SC	SOUTH CAROLINA
46	SD	SOUTH DAKOTA
47	TN	TENNESSEE
48	TX	TEXAS
49	UT	UTAH
50	VT	VERMONT
51	VA	VIRGINIA
53	WA	WASHINGTON
54	WV	WEST VIRGINIA
55	WI	WISCONSIN
56	WY	WYOMING



**APPENDIX III**  
**TABLE 2**

**Gross State Product Industry Codes and Titles**

<u>Industry</u> <u>Code</u>	<u>Title</u>
0	TOTAL
5000	PRIVATE INDUSTRIES
10000	AGRICULTURE, FORESTRY, AND FISHERIES
10010	FARMS
20070	AGRICULTURAL SERVICES, FORESTRY, FISHERIES AND OTHERS
30000	MINING
30100	METAL MINING
30120	COAL MINING
30130	OIL AND GAS EXTRACTION
30140	NONMETALLIC MINERALS, EXCEPT FUELS
40000	CONSTRUCTION
50000	MANUFACTURING
51000	DURABLE GOODS
51240	LUMBER AND WOOD PRODUCTS
51250	FURNITURE AND FIXTURES
51320	STONE, CLAY, AND GLASS PRODUCTS
51330	PRIMARY METAL INDUSTRIES
51340	FABRICATED METAL PRODUCTS
51350	MACHINERY, EXCEPT ELECTRICAL
51360	ELECTRIC AND ELECTRONIC EQUIPMENT
51371	MOTOR VEHICLES AND EQUIPMENT
51379	TRANSPORTATION EQUIPMENT EXCL. MOTOR VEHICLES
51380	INSTRUMENTS AND RELATED PRODUCTS
51390	MISCELLANEOUS MANUFACTURING INDUSTRIES
52000	NONDURABLE GOODS
52200	FOOD AND KINDRED PRODUCTS
52210	TOBACCO MANUFACTURES
52220	TEXTILE MILL PRODUCTS
52230	APPAREL AND OTHER TEXTILE PRODUCTS
52260	PAPER AND ALLIED PRODUCTS
52270	PRINTING AND PUBLISHING
52280	CHEMICALS AND ALLIED PRODUCTS
52290	PETROLEUM AND COAL PRODUCTS
52300	RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS
52310	LEATHER AND LEATHER PRODUCTS





60000	TRANSPORTATION, COMMUNICATION, AND PUBLIC UTILS
62000	TRANSPORTATION
62400	RAILROAD TRANSPORTATION
62410	LOCAL AND INTERURBAN PASSENGER TRANSIT
62420	TRUCKING AND WAREHOUSING
62440	WATER TRANSPORTATION
62450	TRANSPORTATION BY AIR
62460	PIPELINES, EXCEPT NATURAL GAS
62470	TRANSPORTATION SERVICES
64000	COMMUNICATION
66000	ELECTRIC, GAS, AND SANITARY SERVICES
70000	WHOLESALE TRADE
80000	RETAIL TRADE
90000	FINANCE, INSURANCE, AND REAL ESTATE
90600	BANKING
90610	CREDIT AGENCIES OTHER THAN BANKS
90620	HOLDING COS. AND INVESTMENT SERVICES
90630	INSURANCE CARRIERS
90640	INSURANCE AGENTS, BROKERS, AND SERVICES
90650	REAL ESTATE
100000	SERVICES
100700	HOTELS AND OTHER LODGING PLACES
100720	PERSONAL SERVICES
100730	BUSINESS SERVICES
100750	AUTO REPAIR, SERVICES, AND GARAGES
100760	MISCELLANEOUS REPAIR SERVICES
100780	MOTION PICTURES
100790	AMUSEMENT AND RECREATION SERVICES
100800	HEALTH SERVICES
100810	LEGAL SERVICES
100820	EDUCATIONAL SERVICES
100830	SOCIAL SERVICES AND MEMBERSHIP ORGANIZATIONS
100840	MISCELLANEOUS PROFESSIONAL SERVICES
100880	PRIVATE HOUSEHOLDS
110000	GOVERNMENT
111000	FEDERAL CIVILIAN GOVERNMENT
112000	FEDERAL MILITARY GOVERNMENT
113000	STATE AND LOCAL GOVERNMENT



**APPENDIX III  
TABLE 3**

**Line (Industry) Codes for Personal Income, Table CA05**

<u>Line Code</u>	<u>Industry</u>
010	TOTAL PERSONAL INCOME
011	NONFARM PERSONAL INCOME
012	FARM INCOME 2/
020	POPULATION (THOUSANDS) 3/
030	PER CAPITA PERSONAL INCOME (DOLLARS)
040	EARNINGS BY PLACE OF WORK
041	LESS: PERSONAL CONT. FOR SOCIAL INSUR. 4/
042	PLUS: ADJUSTMENT FOR RESIDENCE
045	EQUALS: NET EARN. BY PLACE OF RESIDENCE
046	PLUS: DIVIDENDS, INTEREST, AND RENT 6/
047	PLUS: TRANSFER PAYMENTS
050	WAGES AND SALARIES
060	OTHER LABOR INCOME
070	PROPRIETORS' INCOME 7/
071	FARM
072	NONFARM
081	FARM
082	NONFARM
090	PRIVATE
100	AG. SERV., FOR., FISH., AND OTHER 8/
110	AGRICULTURAL SERVICES
120	FORESTRY, FISHERIES, AND OTHER 8/
121	FORESTRY
122	FISHERIES
123	OTHER 8/
130	MINING
140	COAL MINING
150	OIL AND GAS EXTRACTION
160	METAL MINING

170	NONMETALLIC MINERALS, EXCEPT FUELS
180	CONSTRUCTION
181	GENERAL BUILDING CONTRACTORS
182	HEAVY CONSTRUCTION CONTRACTORS
183	SPECIAL TRADE CONTRACTORS
190	MANUFACTURING
200	NONDURABLE GOODS
210	FOOD AND KINDRED PRODUCTS
220	TEXTILE MILL PRODUCTS
230	APPAREL AND OTHER TEXTILE PRODUCTS
240	PAPER AND ALLIED PRODUCTS
250	PRINTING AND PUBLISHING
260	CHEMICALS AND ALLIED PRODUCTS
270	PETROLEUM AND COAL PRODUCTS
280	TOBACCO MANUFACTURES
290	RUBBER AND MISC. PLASTICS PRODUCTS
300	LEATHER AND LEATHER PRODUCTS
310	DURABLE GOODS
320	LUMBER AND WOOD PRODUCTS
330	FURNITURE AND FIXTURES
340	PRIMARY METAL INDUSTRIES
350	FABRICATED METAL PRODUCTS
360	MACHINERY, EXCEPT ELECTRICAL
370	ELECTRIC AND ELECTRONIC EQUIPMENT
380	TRANS. EQUIP. EXCL. MOTOR VEHICLES
390	MOTOR VEHICLES AND EQUIPMENT
400	ORDNANCE 9/
410	STONE, CLAY, AND GLASS PRODUCTS
420	INSTRUMENTS AND RELATED PRODUCTS
430	MISC. MANUFACTURING INDUSTRIES
440	TRANSPORTATION AND PUBLIC UTILITIES
450	RAILROAD TRANSPORTATION
460	TRUCKING AND WAREHOUSING
470	WATER TRANSPORTATION
480	OTHER TRANSPORTATION
481	LOCAL & INTERURBAN PASSENGER TRANSIT
482	TRANSPORTATION BY AIR
483	PIPELINES, EXCEPT NATURAL GAS
484	TRANSPORTATION SERVICES



490	COMMUNICATION
500	ELECTRIC, GAS, AND SANITARY SERVICES
510	WHOLESALE TRADE
520	RETAIL TRADE
521	BUILDING MATERIALS AND GARDEN EQUIPMENT
522	GENERAL MERCHANDISE STORES
523	FOOD STORES
524	AUTOMOTIVE DEALERS & SERVICE STATIONS
525	APPAREL AND ACCESSORY STORES
526	HOME FURNITURE AND FURNISHINGS STORES
527	EATING AND DRINKING PLACES
528	MISCELLANEOUS RETAIL
530	FINANCE, INSURANCE, AND REAL ESTATE
540	DEPOSITORY & NON-DEP. CREDIT INSTITUTIONS
550	OTHER FINANCE, INSUR., & REAL ESTATE
552	SECURITY & COMMODITY BROKERS & SERV
553	INSURANCE CARRIERS
554	INSURANCE AGENTS, BROKERS, & SERVICES
555	REAL ESTATE
556	COMBINED REAL ESTATE, INSURANCE, ETC. 10/
557	HOLDING & OTHER INVESTMENT COMPANIES
560	SERVICES
570	HOTELS AND OTHER LODGING PLACES
580	PERSONAL SERVICES
590	PRIVATE HOUSEHOLDS
601	BUSINESS SERVICES
602	AUTO REPAIR, SERVICES, AND GARAGES
603	MISCELLANEOUS REPAIR SERVICES
611	AMUSEMENT AND RECREATION SERVICES
612	MOTION PICTURES
621	HEALTH SERVICES
622	LEGAL SERVICES
623	EDUCATIONAL SERVICES
624	SOCIAL SERVICES 11/
625	MUSEUMS, BOTANICAL, ZOOLOGICAL GARDENS
626	MEMBERSHIP ORGANIZATIONS
627	ENGINEERING AND MANAGEMENT SERVICES 12/
628	MISCELLANEOUS SERVICES

630	GOVERNMENT AND GOVERNMENT ENTERPRISES
640	FEDERAL, CIVILIAN
650	MILITARY
660	STATE AND LOCAL



### Footnotes to Table 3

- 1/ 1969-74 BASED ON 1967 SIC. 1975-87 BASED ON 1972 SIC. 1988-90 BASED ON 1987 SIC.
- 2/ FARM INCOME CONSISTS OF PROPRIETORS' NET FARM INCOME, THE WAGES OF HIRED FARM LABOR, THE PAY-IN-KIND OF HIRED FARM LABOR, AND THE SALARIES OF OFFICERS OF CORPORATE FARMS.
- 3/ CENSUS BUREAU MIDYEAR POPULATION ESTIMATES. 1981-89 ARE REVISED AS OF JANUARY 1992 TO REFLECT 1980 + 1990 CENSUS POPULATION COUNTS.
- 4/ PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE ARE INCLUDED IN EARNINGS BY TYPE AND INDUSTRY BUT EXCLUDED FROM PERSONAL INCOME.
- 5/ U.S. ADJUSTMENT FOR RESIDENCE CONSISTS OF ADJUSTMENTS FOR BORDER WORKERS: INCOME OF U.S. RESIDENTS COMMUTING OUTSIDE U.S. BORDERS TO WORK LESS INCOME OF FOREIGN RESIDENTS COMMUTING INSIDE U.S. BORDERS TO WORK PLUS CERTAIN CARIBBEAN SEASONAL WORKERS.
- 6/ INCLUDES THE CAPITAL CONSUMPTION ADJUSTMENT FOR RENTAL INCOME OF PERSONS.
- 7/ INCLUDES THE INVENTORY VALUATION AND CAPITAL CONSUMPTION ADJUSTMENTS.
- 8/ "OTHER" CONSISTS OF WAGES + SALARIES OF U.S. RESIDENTS EMPLOYED BY INTL. ORG. + FOREIGN EMBASSIES + CONSULATES IN THE U.S.
- 9/ UNDER THE 1972 STANDARD INDUSTRIAL CLASSIFICATION, ORDNANCE WAS RECLASSIFIED TO FOUR 2-DIGIT INDUSTRIES: FABRICATED METAL PRODUCTS; ELECTRONIC EQUIPMENT, EXCEPT COMPUTER EQUIPMENT; TRANSPORTATION EQUIPMENT; AND INSTRUMENTS AND RELATED PRODUCTS.
- 10/ UNDER THE 1987 STANDARD INDUSTRIAL CLASSIFICATION, COMBINED REAL ESTATE, INSURANCE, ETC., WAS RECLASSIFIED TO FOUR 2-DIGIT INDUSTRIES: NONDEPOSITORY CREDIT INSTITUTIONS; INSURANCE AGENTS, BROKERS, AND SERVICES: REAL ESTATE; AND LEGAL SERVICES.



- 11/ THIS CATEGORY IS NEW UNDER THE 1972 STANDARD INDUSTRIAL CLASSIFICATION; THEREFORE ESTIMATES PRIOR TO 1975 DO NOT EXIST.
- 12/ THIS CATEGORY IS NEW UNDER THE 1987 STANDARD INDUSTRIAL CLASSIFICATION; THEREFORE ESTIMATES PRIOR TO 1988 DO NOT EXIST.
- 13/ ESTIMATES FOR 1979 FORWARD REFLECT ALASKA CENSUS AREAS AS DEFINED IN THE 1980 DECENNIAL CENSUS; THOSE FOR PRIOR YEARS REFLECT ALASKA CENSUS DIVISIONS AS DEFINED IN THE 1970 DECENNIAL CENSUS. ESTIMATES FROM 1988 FORWARD SEPARATE ALEUTIAN ISLANDS CENSUS AREA INTO ALEUTIANS EAST BOROUGH AND ALEUTIANS WEST CENSUS AREA.
- 14/ FAR WEST REGION TOTALS DO NOT INCLUDE ALASKA AND HAWAII.
- 15/ CIBOLA, NM WAS SEPARATED FROM VALENCIA IN JUNE 1981, BUT IN THESE ESTIMATES, VALENCIA INCLUDES CIBOLA THROUGH THE END OF 1981.
- 16/ LA PAZ COUNTY, AZ WAS SEPARATED FROM YUMA COUNTY ON JANUARY 1, 1983. THE ESTIMATE SHOWN HERE CONSTITUTES THE MAJOR PORTION OF THE TRUE ESTIMATE.



**APPENDIX III  
TABLE 4**

**Line (Industry) Codes for Employment, Table CA25**

<u>Line Code</u>	<u>Industry</u>
10	TOTAL EMPLOYMENT
20	WAGE AND SALARY
40	PROPRIETORS
50	FARM
60	NONFARM 2/
70	FARM
80	NONFARM
90	PRIVATE
100	AG.SERV.,FORESTRY, FISHERIES, AND OTHER 3/
130	MINING
180	CONSTRUCTION
190	MANUFACTURING
440	TRANSPORTATION AND PUBLIC UTILITIES
510	WHOLESALE TRADE
520	RETAIL TRADE
530	FINANCE, INSURANCE, AND REAL ESTATE
560	SERVICES
630	GOVERNMENT AND GOVERNMENT ENTERPRISES
640	FEDERAL, CIVILIAN
650	MILITARY
660	STATE AND LOCAL



#### Footnotes to Table 4

- 1/ 1969-74 BASED ON 1967 SIC. 1975-87 BASED ON 1972 SIC. 1988-90 BASED ON 1987.
- 2/ EXCLUDES LIMITED PARTNERS.
- 3/ "OTHER" CONSISTS OF THE NUMBER OF JOBS HELD BY U.S. RESIDENTS EMPLOYED BY INTERNATIONAL ORGANIZATIONS AND FOREIGN EMBASSIES AND CONSULATES IN THE UNITED STATES.
- 4/ FAR WEST REGION TOTALS DO NOT INCLUDE ALASKA AND HAWAII.
- 5/ CIBOLA, NM WAS SEPARATED FROM VALENICA IN JUNE 1981, BUT IN THESE ESTIMATES VALENCIA INCLUDES CIBOLA THROUGH THE END OF 1981.
- 6/ LA PAZ COUNTY, AZ WAS SEPARATED FROM YUMA COUNTY ON JANUARY 1, 1983.
- 7/ ESTIMATES FOR 1979 FORWARD REFLECT ALASKA CENSUS AREAS AS DEFINED IN THE 1980 DECENNIAL CENSUS; THOSE FOR PRIOR YEARS REFLECT ALASKA CENSUS DIVISIONS AS DEFINED IN THE 1970 DECENNIAL CENSUS. ESTIMATES FROM 1988 FORWARD SEPARATE ALEUTIAN ISLANDS CENSUS AREA INTO ALEUTIANS EAST BOROUGH AND ALEUTIANS WEST CENSUS AREA.



## APPENDIX IV

The following descriptions of the functional expenditure categories relevant for this study are obtained from the *Classification Manual*, Government Finance and Employment, U.S. Bureau of the Census, June 1992.



FUNCTION CODE: 44

NAME: Regular Highways

SECTOR: General

APPLIES TO: Finance |X| Employment |X|

PUBLICATION CATEGORIES: Transportation  
Highways

**DEFINITION:** Maintenance, operation, repair, and construction of nontoll highways, streets, roads, alleys, sidewalks, bridges, tunnels, ferry boats, viaducts, and related structures.

**EXAMPLES:** Snow and ice removal and application of salt and sand (including that by sanitation or street cleaning agencies, if identifiable); street or highway lighting and related fixtures; traffic signals; highway and traffic design, planning, and engineering IF handled by public works or highways agency; highway safety; nontoll ferries; operation of drawspans; garages, administrative buildings, and other facilities of highway agencies; construction and maintenance of such highway-related items as curbs, gutters, storm drains that are integral to highway projects; value of prison labor provided by corrections agencies; intergovernmental payments for highways (toll or free), including state aid for debt service on local highway debt.

**EXCLUSIONS:** Patrol or policing of streets and highways and traffic control activities of police or public safety agencies (report at *Police Protection*, code 62); street cleaning activities (report at *Solid Waste Management*, code 81); local public parking facilities or meters (report at *Parking Facilities*, code 60); operation of water transport and terminal facilities (use code 87); roads and walkways within parks and maintained by a park agency (report at *Parks and Recreation*, code 61); drainage unrelated to highway projects (report at *Other Natural Resources*, code 59).

**REFERENCES:** <To be added later.>

**OTHER NOTES:** (1) Report cost of street lighting furnished by an electric utility operated by same government here and deduct an equal amount from *Electric Power* utility, code E92. (2) Effective with 1988 data, the treatment of traffic engineering was clarified to include it here unless expressly handled by a police agency. (3) Report employment data for toll highways here.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

General Purpose Governments

	<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>						
E44 Current Operations	.	.	.	.	.	.
I44 Assistance and subsidies	.	N	N	N	N	N
F44 Construction	.	.	.	.	.	.
G44 Land & existing structures	.	.	.	.	.	.
K44 Equipment	.	.	.	.	N	N
<b>INTERGOVERNMENTAL, TO:</b>						
L44 State	.	N	N	.	.	.
M44 Locals, NEC	.	.	.	.	.	.
N44 General purpose locals	N	.	N	N	N	N
R44 Special districts	N	.	N	N	N	N
<b>EMPLOYMENT DATA</b>						
	.	.	.	.	.	.

\*Shows whether data are collected (.) or not collected (N) for that type.

44(0)-6/92



FUNCTION CODE: 45

NAME: Toll Highways

SECTOR: General

APPLIES TO: Finance |X| Employment | |

PUBLICATION CATEGORIES: Transportation  
Highways

**DEFINITION:** Maintenance, operation, repair, and construction of highways, roads, bridges, ferries, and tunnels operated on a fee or toll basis.

**EXAMPLES:** Turnpikes, toll roads, toll bridges, toll ferries (including docks and related terminals), toll tunnels, and all related activities and facilities such as snow and ice removal, highway police and fire protection units IF administered by the toll authority, lighting and light fixtures, design and engineering, garages and administrative buildings of toll authorities, operation of toll booths, drawspans, rest stops, and service areas by the toll authority itself.

**EXCLUSIONS:** Debt service on toll facility debt (report interest payments at code I89 and repayment of principal at appropriate debt retirement code, 3-X); intergovernmental aid for toll facilities, including state aid for debt service on local highway debt (report at *Regular Highways*, code 44); police and fire protection services not provided by toll authority itself (report at *Police Protection*, code 62, or *Fire Protection*, code 24); free ferries (use code 44).

**REFERENCES:** <To be added later.>

**OTHER NOTES:** (1) This function includes direct expenditures only -- report any intergovernmental outlays at *Regular Highways*, code 44. (2) Report expenditures without deducting any related tolls or charges. (3) For leased facilities include government's expenditures and exclude those of the lessees'. (4) Report any related special district expenditures and all employment data at *Regular Highways*, code 44.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

	<u>General Purpose Governments</u>					
	<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>						
E45 Current Operations	N	.	.	.	.	N
F45 Construction	N	.	.	.	.	N
G45 Land & existing structures	N	.	.	.	.	N
K45 Equipment	N	.	.	.	N	N

\*Shows whether data are collected (.) or not collected (N) for that type.

45(0)-6/92



FUNCTION CODE: 01

NAME: Air Transportation (Airports)

SECTOR: General

APPLIES TO: *Finance* |X| *Employment* |X|

PUBLICATION CATEGORIES: Transportation

**DEFINITION:** Provision, operation, construction, and support of airport facilities serving the public-at-large on a scheduled or unscheduled basis; and the regulation of the airline industry.

**EXAMPLES:** Publicly-operated airfields and related facilities (runways, terminals, control towers, maintenance facilities, and the like); intergovernmental payments for construction, operation, or support of the publicly-owned airports; support of private airports; Federal Aviation Administration (FAA); airport police if either an integral part of the airport authority or a payment to regular police agency (see Other Notes below).

**EXCLUSIONS:** Purchase and operation of government-owned aircraft -- e.g., policy helicopters (report at function involved); state civil air patrol or militia (report at *Other and Unallocable*, code 89).

**REFERENCES:** <To be added later.>

**OTHER NOTES:** (1) Includes publicly-owned airports even if no scheduled airlines service it or if its clientele consists of private pilots and aircraft. (2) For leased facilities include government's expenditures and employees and exclude the lessees' expenditures and contractual employment. (3) Report payments by an airport authority to a regular police department of the same government at E01 and deduct an equal amount from *Police Protection*, code E62. The rationale for this procedure is that the primary function involved is air transportation.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

		<u>General Purpose Governments</u>					
		<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>							
E01	Current Operations	.	.	.	.	.	.
I01	Assistance and subsidies	.	N	N	N	N	N
F01	Construction	.	.	.	.	.	.
G01	Land & existing structures	.	.	.	.	.	.
K01	Equipment	.	.	.	.	N	N
<b>INTERGOVERNMENTAL, TO:</b>							
L01	State	.	N	N	.	.	.
M01	Locals, NEC	.	.	.	.	.	.
N01	General purpose locals	N	.	N	N	N	N
R01	Special districts	N	.	N	N	N	N
<b>EMPLOYMENT DATA</b>		.	.	.	.	.	.

\*Shows whether data are collected (.) or not collected (N) for that type.

01(0)-6/92



FUNCTION CODE: 94

NAME: Public Mass Transit Systems

SECTOR: Utilities

APPLIES TO: Finance |X| Employment |X|

PUBLICATION CATEGORIES: Utilities

**DEFINITION:** Rapid transit; subways, surface rail, and street railroad systems; commuter rail lines; trolleys and light rail; related stations, tracks, depots, and railyards; acquisition of right-of-ways; transit police employed directly by utility; subsidies to public mass transit systems (but not private ones); buses.

**EXCLUSIONS:** Systems solely to transport students (report at *Elementary and Secondary Education*, code 12); ferries (if free, report at *Regular Highways*, code 44, else report at *Toll Highways*, code 45); systems exclusively for handicapped or senior citizens (report at *Other Public Welfare*, code 79); subsidies for private mass transit systems (report at *Transit Subsidies*, code E47); contributions to own system (use exhibit code Z61); systems owned but operated under private contract without financial oversight (report at *Miscellaneous Commercial Activities*, code 03); depreciation of assets; activities not directly related to utility operation, such as administration of utility data (report at *Financial Administration*, code 23) and payments-in-lieu-of-taxes; benefits paid to utility employees by employee retirement systems (use code X11).

**REFERENCES:** <To be added later.>

**OTHER NOTES:** (1) Relates only to systems owned and operated by a government or managed by private contractor when government maintains day-to-day financial oversight (e.g., by directly paying utility employees). (2) Prior to 1977 data, this function applied only to local governments. Effective with 1977 data, it was extended to cover state governments, whose activities were reported previously at code 03. (3) Intergovernmental expenditure codes were added effective with 1988 data, for users who seek to identify certain utility transactions already classed as a general intergovernmental expenditure, such as subsidies to public transit systems (previously reported at code 47). In publications, however, these amounts will continue to be treated as general expenditures despite their utility suffix; utility expenditures will continue to exclude them and to represent direct outlays only.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

		<u>General Purpose Governments</u>					
		<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>							
E94	Current Operations	N	.	.	.	.	.
I94	Interest on debt	N	.	.	.	.	.
F94	Construction	N	.	.	.	.	.
G94	Land & existing structures	N	.	.	.	.	.
K94	Equipment	N	.	.	.	N	N
<b>INTERGOVERNMENTAL, TO:</b>							
L94	State	N	N	N	.	.	.
M94	Locals, NEC	N	.	.	.	.	.
N94	General purpose locals	N	.	N	N	N	N
R94	Special districts	N	.	N	N	N	N
<b>EMPLOYMENT DATA</b>		N	.	.	.	.	.

\*Shows whether data are collected (.) or not collected (N) for that type.

94(0)-6/92

FUNCTION CODE: 47

NAME: Private Transit Subsidies

SECTOR: General

APPLIES TO: Finance |X| Employment | |

PUBLICATION CATEGORIES: Transportation

DEFINITION: Payments in support of privately-owned and operated transit utility operations, including railroads.

EXAMPLES: Payments of subsidies to private bus companies, railways, light rail, or other private passenger transportation systems for construction, purchase of equipment, and operations; subsidies to railroads for continued service to rural or outlying areas.

EXCLUSIONS: Payments in support of highway-related activities (report at *Regular Highways*, code 44); subsidies to transit utilities operated by other governments (report at *Transit Systems*, code 94); payments to private firms to provide transportation for government employees -- e.g., shuttle bus service between public buildings (report at function of paying agency or at *Other and Unallocable*, code 89); payments to private firms for transporting pupils (report at *Elementary and Secondary Education*, code 12); subsidies or contributions to own transit system (use exhibit-only code Z61).

REFERENCES: <To be added later.>

OTHER NOTES: (1) Effective with 1988 data, payments to other governments for support of their transit operations are classified at *Transit Systems*, code 94, rather than here. Created as an aid to users, these intergovernmental expenditures codes for transit utilities will continue to be reported as general government activities in Census Bureau publications. (2) No employment data are associated with this function. (3) Report Federal Government mass transit grants at *Other and Unallocable*, code 89. (4) This function was added to the classification manual beginning with fiscal year 1976-77 data.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

General Purpose Governments

		<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>							
E47	Current Operations	N	.	.	.	.	.
<b>EXHIBIT-ONLY CODE:</b>							
Z61	Contribution to own transit system	N	.	N	.	.	N

\*Shows whether data are collected (.) or not collected (N) for that type.

47(0)-6/92



FUNCTION CODE: 87

NAME: Water Transport and Terminals

SECTOR: General

APPLIES TO: Finance |X| Employment |X|

PUBLICATION CATEGORIES: Transportation

**DEFINITION:** Provision, construction, operation, maintenance, and support of public waterways and harbors, docks, wharves, and related marine terminal facilities; and the regulation of the water transportation industry.

**EXAMPLES:** Commercial port facilities, canals, harbors, and other public waterways; dredging of same; public docks, piers, wharves, warehouses, cranes, and associated terminal facilities; regulatory and inspection of the commercial water transportation industry. For Federal Government also includes waterways navigation activities of the Army Corps of Engineers, most of the Maritime Administration, and the Panama Canal Commission.

**EXCLUSIONS:** Recreational types of docks and marine facilities -- e.g., public marinas devoted to pleasure boaters (report at *Parks and Recreation*, code 61); terminals and dock facilities for public ferries (if toll, report expenditures at *Toll Highways*, code 45, else report expenditures and any employment at *Regular Highways*, code 44).

**REFERENCES:** <To be added later.>

**OTHER NOTES:** (1) This category is devoted to commercial water transportation and terminals rather than the provision of water-related activities and facilities for pleasure or recreation. (2) For leased facilities include only government's expenditures and employees and exclude the lessees' expenditures and contractual employment.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

		<u>General Purpose Governments</u>					
		<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>							
E87	Current Operations	.	.	.	.	.	.
I87	Assistance and subsidies	.	N	N	N	N	N
F87	Construction	.	.	.	.	.	.
G87	Land & existing structures	.	.	.	.	.	.
K87	Equipment	.	.	.	.	N	N
<b>INTERGOVERNMENTAL, TO:</b>							
L87	State	.	N	N	.	.	.
M87	Locals, NEC	.	.	.	.	.	.
N87	General purpose locals	N	.	N	N	N	N
R87	Special districts	N	.	N	N	N	N
<b>EMPLOYMENT DATA</b>		.	.	.	.	.	.

\*Shows whether data are collected (.) or not collected (N) for that type.

87(0)-6/92





FUNCTION CODE: 91

NAME: Water Supply

SECTOR: Utilities

APPLIES TO: Finance |X| Employment |X|

PUBLICATION CATEGORIES: Utilities

**DEFINITION:** Operation, maintenance, and construction of public water supply systems, including production, acquisition, and distribution of water to general public or to other public or private utilities, for residential, commercial, and industrial use.

**EXAMPLES:** Dams and reservoirs expressly for water supply; purification and filtration plants; pumping stations; aqueducts and transmission systems; water storage tanks; purchase of water for resale; distribution lines and meters.

**EXCLUSIONS:** Contributions to parent government; purchase of water for other than resale and provision of water to parent government (report, where identifiable, at function involved); facilities owned but leased to other governments or persons without financial oversight (report at *Miscellaneous Commercial Activities*, code 03); depreciation of assets; activities not directly related to utility operations, such as administration of utility debt or investments (report at *Financial Administration*, code 23) and payments-in-lieu-of-taxes; benefits paid to utility employees by employee retirement systems (use code X11); acquisition and distribution of water for irrigation (report at *Other Natural Resources*, code 59).

**REFERENCES:** < To be added later. >

**OTHER NOTES:** (1) Relates only to systems owned and operated by a government or managed by private contractor when government maintains day-to-day financial oversight (e.g., by directly paying utility employees). (2) Prior to 1977 data, this function applied only to local governments. Effective with 1977 data, it was extended to cover state governments, whose activities were reported previously at code 03. (3) For combined water-sewer systems, include segregable amounts related to water supply here (report at *Sewerage* activities at code 80). (4) Intergovernmental expenditure codes were added, effective with 1988 data, for users who seek to identify certain utility transactions already classed as general intergovernmental expenditure, such as state grants for local purification plants. In publications, however, these amounts will continue to be treated as general expenditures despite their utility suffix; utility expenditures will continue to exclude them and to represent direct outlays only.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

General Purpose Governments

	<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>						
E91 Current Operations	N	.	.	.	.	.
I91 Interest on debt	N	.	.	.	.	.
F91 Construction	N	.	.	.	.	.
G91 Land & existing structures	N	.	.	.	.	.
K91 Equipment	N	.	.	.	N	N
<b>INTERGOVERNMENTAL, TO:</b>						
L91 State	N	N	N	.	.	.
M91 Locals, NEC	N	.	.	.	.	.
N91 General purpose locals	N	.	N	N	N	N
R91 Special districts	N	.	N	N	N	N
<b>EMPLOYMENT DATA</b>		N	.	.	.	..

\*Shows whether data are collected (.) or not collected (N) for that type.

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FUNCTION CODE: 80

NAME: Sewerage

SECTOR: General

APPLIES TO: *Finance* |X| *Employment* |X|

PUBLICATION CATEGORIES: **Environment and Housing  
Sanitation**

**DEFINITION:** Provision, maintenance, and operation of sanitation and storm sewer systems and sewage disposal and treatment facilities.

**EXAMPLES:** Construction and maintenance of sanitary sewer lines; sewer cleaning; lift or pump stations; sewage treatment plants; water pollution control plants; storm drains that are not connected with highway projects; systems for the collection and disposal of storm runoff; and any intergovernmental payments for such activities.

**EXCLUSIONS:** Storm drains that are integral part of highway projects (report at either *Regular Highways*, code 44, or *Toll Highways*, code 45); drainage for agricultural or other nonstreet purposes (report Federal activities at *Soil, Water, and Electric Energy Resources*, code 57, and state-local activities at *Other Natural Resources*, code 59).

**REFERENCES:** <To be added later.>

**OTHER NOTES:** (1) For combined water supply and sewer systems, include segregable amounts related to sewage collection and disposal here and *Water Supply* activities at code 91. (2) Prior to 1977 data, this function applied only to local governments; effective with 1977 data, it was extended to cover state governments, whose activities were reported previously at *Other and Unallocable*, code 89. (3) For Federal Government, report grants to state and local governments for wastewater treatment plant construction at code 89.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

		<u>General Purpose Governments</u>					
		<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>							
E80	Current Operations	N	.	.	.	.	.
F80	Construction	N	.	.	.	.	.
G80	Land & existing structures	N	.	.	.	.	.
K80	Equipment	N	.	.	.	N	N
<b>INTERGOVERNMENTAL, TO:</b>							
L80	State	N	N	N	.	.	.
M80	Locals, NEC	N	.	.	.	.	.
N80	General purpose locals	N	.	N	N	N	N
R80	Special districts	N	.	N	N	N	N
<b>EMPLOYMENT DATA</b>		N	.	.	.	.	.

\*Shows whether data are collected (.) or not collected (N) for that type.

80(0)-6/92



FUNCTION CODE: 81

NAME: Solid Waste Management

SECTOR: General

APPLIES TO: Finance |X| Employment |X|

PUBLICATION CATEGORIES: Environment and Housing  
Sanitation

**DEFINITION:** Collection, removal, and disposal of garbage, refuse, hazardous, and other solid wastes; and cleaning of streets, alleys, and sidewalks.

**EXAMPLES:** Garbage collection; sanitary landfills; hazardous waste disposal sites; incinerators; pyrolysis facilities; cleanup of toxic chemical spills and dumps; collection and disposal of abandoned vehicles; resource recovery authorities, including those which cogenerate electricity or gas as a by-product; recycling centers; Federal "Superfund" activities; cleaning and washing of streets; and collection and disposal of street debris and trash.

**EXCLUSIONS:** Distinctive amounts of snow and ice removal by a sanitation agency (report at *Highways*, codes 44/45).

**REFERENCES:** < To be added later. >

**OTHER NOTES:** (1) Effective with 1988 data, this category was (a) expanded to include the activities of the Federal and state governments, formerly classed at *Other and Unallocable*, and (b) renamed from "Sanitation other than Sewerage." (2) The rationale for including at this function waste or resource recovery facilities that cogenerate gas or electricity is that their primary purpose is disposing of wastes.

-----DETAILED CODE LIST WITH COVERAGE OF DATA COLLECTION\*-----

		<u>General Purpose Governments</u>					
		<u>Federal</u>	<u>State</u>	<u>DC</u>	<u>Large city- county</u>	<u>Other Local</u>	<u>Special district</u>
<b>EXPENDITURES, DIRECT</b>							
E81	Current Operations	.	.	.	.	.	.
F81	Construction	.	.	.	.	.	.
G81	Land & existing structures	.	.	.	.	.	.
K81	Equipment	.	.	.	.	N	N
<b>INTERGOVERNMENTAL, TO:</b>							
L81	State	.	N	N	.	.	.
M81	Locals, NEC	.	.	.	.	.	.
N81	General purpose locals	N	.	N	N	N	N
R81	Special districts	N	.	N	N	N	N
<b>EMPLOYMENT DATA</b>		N	.	.	.	.	.

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This interim report is a follow-up to a July 1993 publication entitled "Infrastructure in the 21st Century Economy: A Review of the Issues and Outline of a Study fo the Impacts of Federal Infrastructure Investments (IWR Report 93-FIS-4). That first report described the beginning of the effort in which the Corps presented a "strawman" scope of work to three different panels composed of professional economists and other staff from Federal agencies, Congress and academia, and solicited participation in devising a concrete research plan.

This report describes developments since that initial workplan was articulated and is printed in three volumes. This volume (Volume 3) contains the details of a database on public capital collected and developed by Apogee Research, Inc. These data namely: a Computable General Equilibrium (CGE) approach; and econometric cost function/productivity approach; and an endogenous dynamic growth approach.

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